

**02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and  
co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS**

Submit only ONE copy of this form for each PI/PD and co-PI/PD identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.B. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. **DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.**

**PI/PD Name:** Edward A Fox

**Gender:** ☒ Male ☐ Female

**Ethnicity:** (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

**Race:**  
(Select one or more)

☐ American Indian or Alaska Native  
☐ Asian  
☐ Black or African American  
☐ Native Hawaiian or Other Pacific Islander  
☒ White

**Disability Status:**  
(Select one or more)

☐ Hearing Impairment  
☐ Visual Impairment  
☐ Mobility/Orthopedic Impairment  
☐ Other  
☒ None

**Citizenship:** (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

**Check here if you do not wish to provide any or all of the above information (excluding PI/PD name):** ☒

**REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project** ☒

**Ethnicity Definition:**

**Hispanic or Latino.** A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.

**Race Definitions:**

**American Indian or Alaska Native.** A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.

**Asian.** A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

**Black or African American.** A person having origins in any of the black racial groups of Africa.

**Native Hawaiian or Other Pacific Islander.** A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

**White.** A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

**WHY THIS INFORMATION IS BEING REQUESTED:**

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PIs/PDs. To gather information needed for this important task, the proposer should submit a single copy of this form for each identified PI/PD with each proposal. Submission of the requested information is voluntary and will not affect the organization's eligibility for an award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information received from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. (The exceptions are the PI/PD name and the information about prior Federal support, the last question above.)

Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational opportunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

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**PI/PD Name:** Barbara Wildemuth

**Gender:** ☐ Male ☒ Female

**Ethnicity:** (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

**Race:**  
(Select one or more)

☐ American Indian or Alaska Native  
☐ Asian  
☐ Black or African American  
☐ Native Hawaiian or Other Pacific Islander  
☒ White

**Disability Status:**  
(Select one or more)

☐ Hearing Impairment  
☐ Visual Impairment  
☐ Mobility/Orthopedic Impairment  
☐ Other  
☐ None

**Citizenship:** (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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0535060

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**PI/PD Name:** Jeffrey P Pomerantz

**Gender:** ☒ Male ☐ Female

**Ethnicity:** (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

**Race:**  
(Select one or more)

☐ American Indian or Alaska Native  
☐ Asian  
☐ Black or African American  
☐ Native Hawaiian or Other Pacific Islander  
☒ White

**Disability Status:**  
(Select one or more)

☐ Hearing Impairment  
☐ Visual Impairment  
☐ Mobility/Orthopedic Impairment  
☐ Other  
☒ None

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## List of Suggested Reviewers or Reviewers Not To Include (optional)

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### **SUGGESTED REVIEWERS:**

Not Listed

### **REVIEWERS NOT TO INCLUDE:**

Not Listed

## List of Suggested Reviewers or Reviewers Not To Include (optional)

---

### **SUGGESTED REVIEWERS:**

Not Listed

### **REVIEWERS NOT TO INCLUDE:**

Not Listed

# COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 04-23					FOR NSF USE ONLY	
NSF 05-551 05/05/05					NSF PROPOSAL NUMBER	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					0535057	
IIS - DIGITAL LIBRARIES AND ARCHIVES						
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
05/05/2005	4	05020000 IIS	6857	003137015	11/09/2005 2:16pm S	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)		
546001805						
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF Awardee ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
Virginia Polytechnic Institute and State University			460 Turner Street			
AWARDEE ORGANIZATION CODE (IF KNOWN)			Suite 306			
0037549000			BLACKSBURG, VA 24060-0000			
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
IS Awardee ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)			<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS	
					<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE	
TITLE OF PROPOSED PROJECT Collaborative Research: Curriculum Development: Digital Libraries						
REQUESTED AMOUNT		PROPOSED DURATION (1-60 MONTHS)		REQUESTED STARTING DATE		SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
\$ 272,187		36 months		01/01/06		
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.A)			<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.6)			
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)			Exemption Subsection _____ or IRB App. Date _____			
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)			<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)			
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)						
<input type="checkbox"/> SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)						
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____			<input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)			
PI/PD DEPARTMENT			PI/PD POSTAL ADDRESS			
Department of Computer Science			660 McBryde Hall			
PI/PD FAX NUMBER			Blacksburg, VA 240610106			
540-231-6075			United States			
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
PI/PD NAME						
Edward A Fox	PhD	1983	540-231-5113	fox@vt.edu		
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						

## CERTIFICATION PAGE

### Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the individual applicant or the authorized official of the applicant institution is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 04-23. Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

In addition, if the applicant institution employs more than fifty persons, the authorized official of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of Grant Policy Manual Section 510; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

### Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Appendix C of the Grant Proposal Guide.

### Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency?

Yes ☐

No ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Appendix D of the Grant Proposal Guide.

### Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

### Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE		DATE	
NAME		Electronic Signature		May 5 2005 3:15PM	
Ross M Verbrugge					
TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS			FAX NUMBER	
540-231-6042	rossv@vt.edu			540-231-4822	

\*SUBMISSION OF SOCIAL SECURITY NUMBERS IS VOLUNTARY AND WILL NOT AFFECT THE ORGANIZATION'S ELIGIBILITY FOR AN AWARD. HOWEVER, THEY ARE AN INTEGRAL PART OF THE INFORMATION SYSTEM AND ASSIST IN PROCESSING THE PROPOSAL. SSN SOLICITED UNDER NSF ACT OF 1950, AS AMENDED.

# COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 04-23					<b>FOR NSF USE ONLY</b>	
<b>NSF 05-551</b>			<b>05/05/05</b>			<b>NSF PROPOSAL NUMBER</b> <span style="font-size: 2em; font-weight: bold;">0535060</span>
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)						
<b>IIS - DIGITAL LIBRARIES AND ARCHIVES</b>						
<b>DATE RECEIVED</b>	<b>NUMBER OF COPIES</b>	<b>DIVISION ASSIGNED</b>	<b>FUND CODE</b>	<b>DUNS#</b> (Data Universal Numbering System)	<b>FILE LOCATION</b>	
<b>05/05/2005</b>	<b>4</b>	<b>05020000 IIS</b>	<b>6857</b>	<b>608195277</b>	<b>11/09/2005 2:16pm S</b>	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)		
<b>566001393</b>						
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF Awardee ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
<b>University of North Carolina at Chapel Hill</b>			<b>104 AIRPORT DR STE 2200</b>			
AWARDEE ORGANIZATION CODE (IF KNOWN)			<b>CHAPEL HILL, NC 27599-9000</b>			
<b>0029744000</b>						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
IS Awardee ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)			<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS	
<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE						
TITLE OF PROPOSED PROJECT <b>Collaborative Research: Curriculum Development: Digital Libraries</b>						
REQUESTED AMOUNT \$ <b>262,407</b>		PROPOSED DURATION (1-60 MONTHS) <b>36</b> months		REQUESTED STARTING DATE <b>01/01/06</b>		
SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE						
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.A) <input checked="" type="checkbox"/> HUMAN SUBJECTS (GPG II.D.6) <input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)      Exemption Subsection _____ or IRB App. Date <b>Pending</b> <input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d) <input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j) <input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j) <input type="checkbox"/> SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1) <input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____ <input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)						
PI/PD DEPARTMENT <b>School of Info and Lib Science</b>			PI/PD POSTAL ADDRESS <b>100 Manning Hall, CB #3360</b>			
PI/PD FAX NUMBER <b>919-962-8071</b>			<b>Chapel Hill, NC 275993360</b> <b>United States</b>			
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
<b>PI/PD NAME</b> <b>Barbara Wildemuth</b>	<b>PhD</b>	<b>1989</b>	<b>919-962-8072</b>	<b>wildem@ils.unc.edu</b>		
<b>CO-PI/PD</b> <b>Jeffrey P Pomerantz</b>	<b>PhD</b>	<b>2003</b>	<b>919-962-8064</b>	<b>pomerantz@unc.edu</b>		
<b>CO-PI/PD</b>						
<b>CO-PI/PD</b>						
<b>CO-PI/PD</b>						



## CERTIFICATION PAGE

### Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the individual applicant or the authorized official of the applicant institution is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 04-23. Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE		DATE	
NAME <b>Vickie C Elmore</b>		<b>Electronic Signature</b>		<b>May 5 2005 3:16PM</b>	
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## ***Collaborative Research: Curriculum Development: Digital Libraries — SUMMARY***

**Problem:** In this project, Virginia Tech (VT) and the University of North Carolina at Chapel Hill (UNC) address the important problem of preparing students of computer science, or library and information science, for study and workforce opportunities in the Digital Libraries (DLs) area. While research into DLs has made great progress, and the *ACM/IEEE-CS Computing Curricula 2001* includes DLs, there is as yet no consensus on curriculum or courseware for DL education. A further underlying problem is the lack of consensus on unifying formal theories and on an integrative and firm foundation for the area.

**Objectives, Outcomes, Procedures:** Our objectives, outcomes, and procedures include: 1) developing and validating DL curricular and educational materials at VT and UNC, in concert with supporters around the nation; 2) extending the 5S (Societies, Scenarios, Spaces, Structures, and Streams) integrative framework to provide a firm foundation for DL education; and 3) disseminating materials and findings through key conferences (including the JCDL Doctoral Consortium), the WWW, and our NSF-funded Computing and Information Technology Interactive Digital Educational Library (CITIDEL, see [www.citidel.org](http://www.citidel.org) – part of NSDL, the National Science Digital Library).

**Solving the Problem:** Virginia Tech has offered courses on DL-related topics since 1973, and on DLs since 1997. Library education at UNC began in 1904, the School of Library Science (ranked #1 by *US News and World Report*) opened in 1931, and a DL course has been offered since 2001. VT has demonstrated the effectiveness of modules and a lab-based approach in these areas, with enhanced benefits through use of digital libraries and concept maps. Building upon this background and 6 years developing the 5S approach (with ongoing funding from an NSF ITR project launched in fall 2003), and with guidance from local experts and an Advisory Board, we will advance DL education – identifying curricular needs, and preparing modules and lessons – iterating over two development and evaluation phases.

**Notable Collaborations:** As can be seen from the Advisory Board list, we will have assistance from many of the key groups working on R&D in DL and related areas. PI Fox will build upon connections from having served as chair of ACM SIGIR and the NSDL Policy Committee, and now serving as director of CITIDEL, member of the ACM SIGMM Executive Committee, and chair of the IEEE-CS Technical Committee on Digital Libraries. Co-PI Wildemuth has been active in ASIS&T for 30 years, serving on a number of national committees and chairing several special interest groups. She is Program Co-Chair for the 2005 Annual Meeting, and co-PI on the NSF-funded Open Video project. Co-PI Pomerantz has worked extensively with the Information Institute of Syracuse (IIS) on projects to integrate services into DLs, including the NSDL, as well as projects to develop educational and training materials for digital reference work, including the Digital Reference Education Initiative project.

**Intellectual Merit:** This project builds upon scores of NSF-funded projects, the results of which can be applied to teaching and learning. Thus, in addition to the CITIDEL effort, grants on “Interactive Learning with a Digital Library in Computer Science”, “A Digital Library Based Computer Science Teaching Center”, “Curriculum Resources in Interactive Multimedia”, “A Digital Library of Reusable Science and Math Resources for Undergraduate Education”, “International Guide for the Creation of Electronic Theses and Dissertations”, “Intelligent Collection Services for and about Educators and Students: Logging, Spidering, Analysis and Visualization”, and “Agile Views for Video Browsing: Advanced Surrogates, Control Mechanisms, and Usability” – as well as 22 years of teaching at VT and 19 years at UNC – will be leveraged so that DL research and education will feed into curricula and educational materials for the area. Further, 5S provides a firm and integrative intellectual foundation for proposed work, so we can be certain to cover key ideas, spanning the range from definitions to services to quality.

**Broader Impact:** The DL educational materials developed through this project will have a strong positive impact nationwide on the education of the next generation of digital librarians and DL developers, providing educators with a strong basis for locally-customized curricula in DLs. Dissemination of these modules and results, through the CITIDEL project and through conference participation, as well as through the large number of participating experts, will help to speed their diffusion into the leading U.S. schools, yielding benefits in the development and management of DLs and the provision of DL services.

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Budget (Plus up to 3 pages of budget justification)	5	
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Appendix Items:		

\*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

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## ***Collaborative Research: Curriculum Development: Digital Libraries***

### **1. Problem**

There is an urgent need for curriculum development for the area of Digital Libraries (DLs) [1-18]. Hundreds of millions of dollars of R&D investment in the DL area, including research on how DLs can aid education [19-22], has been made since the early 1990's [23-28], but there has been no parallel investment to support teaching and learning about DLs. While ongoing R&D investment is of critical importance in the USA (especially since funding in the area also is increasing in Australia, China, Europe, India, Japan, and other locations [27-33]), it is important too for more of the pilot studies and experimental systems (e.g., Google, which evolved from work at Stanford funded in 1994 by NSF's Digital Libraries Initiative [15]) to inform the "standard" way in which people obtain access to information they need. To reach that goal, we should invest in the education of information professionals who fully understand the processes by which DLs are developed and their users are supported, as well as the potential of DLs for affording novel information services.

Without investment in education related to DLs, we face a future with many digital libraries, but few digital librarians to ensure their success. We run the risk of developers of digital library systems building software that is seriously flawed – since they will not be aware of crucial requirements [34, 35], efficient and effective techniques for implementation [36-40], or key ingredients of success [41]. End users already are facing a confusing situation where their ability to work with useful information is limited by failures of usability and interoperability [42-46]. Sponsors of some early digital libraries now wonder about their sustainability [47], or are concerned about their long-term viability with regard to digital preservation [48-61]. Those involved in requirements analysis, design, development, management, and utilization of many types of related advanced information systems also face similar problems, which might be avoided with the help of those who have had formal training regarding DLs.

These issues are of primary concern in two related disciplines: Computer Science (CS) and Library and Information Science (LIS). For CS graduates, DLs represent an opportunity to further develop and apply new technologies, leading to integrated information systems that go beyond the currently popular divisions between portals, search engines, database systems, and multimedia/hypermedia (Web) information systems. For LIS graduates, DLs represent an opportunity to apply these new technologies to providing library services to an increasingly diverse and distributed population of those needing access to digital information resources.

However, there are currently no formal degree programs in digital librarianship, and only a few universities offer specific courses on DLs. A handful of LIS programs have begun offering certificate programs in digital librarianship, but there is little agreement as to the content and scope of these programs, and little coordination between institutions, or between LIS and CS departments. While Computing Curriculum 2001 (CC2001, a joint effort of ACM and IEEE-CS published in late 2001, defining curricula for CS [62, 63] and related programs [64]) includes DLs as one of 14 knowledge modules in Information Management (see Table 1), no further work has been supported to develop a DL curriculum beyond the brief CC2001 description.

**Table 1. CC2001 Information Management Areas**

IM1. Information models and systems*	IM8. Distributed DBs
IM2. Database systems*	IM9. Physical DB design
IM3. Data modeling*	IM10. Data mining
IM4. Relational DBs	IM11. Information storage and retrieval
IM5. Database query languages	IM12. Hypertext and hypermedia
IM6. Relational DB design	IM13. Multimedia information & systems
IM7. Transaction processing	IM14. Digital libraries

\* Core components

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A further underlying problem is the lack of consensus on unifying formal theories and on an integrative and firm foundation for education related to DLs. This problem was highlighted by Licklider almost 40 years ago in his prescient book that anticipated the current interest in DLs [65]. The importance of work to develop a theory of digital libraries has been highlighted in a recent NSF-sponsored workshop to chart the future of the area [66].

### 2. Approach to Curriculum Development: Courses, Topics/Modules, and Lessons

We propose curriculum development within the preliminary framework illustrated in Figure 1. For programs emphasizing digital libraries, a 2-semester sequence might be appropriate. For more general Computer Science (CS) or Library and Information Science (LIS) programs, a 1-semester course may be most popular. As an alternative or in addition to a single course, one or more of the core DL topics and/or some of the related topics might be implemented as modules within courses on database, HCI [67, 68], information retrieval [69], multimedia [70, 71], or WWW [72]. The mission of a particular school will affect the emphasis placed on DLs within its curriculum. Therefore we propose to develop educational materials at three levels of granularity: 1) specific lessons that can be implemented within the context of a DL course or a related course; 2) educational modules, each covering an individual topic (both core topics and related topics, as shown in Figure 1); and 3) course outlines and a textbook (e.g., one under development by the PI as part of his current sabbatical leave) appropriate for one or two semester-long courses.

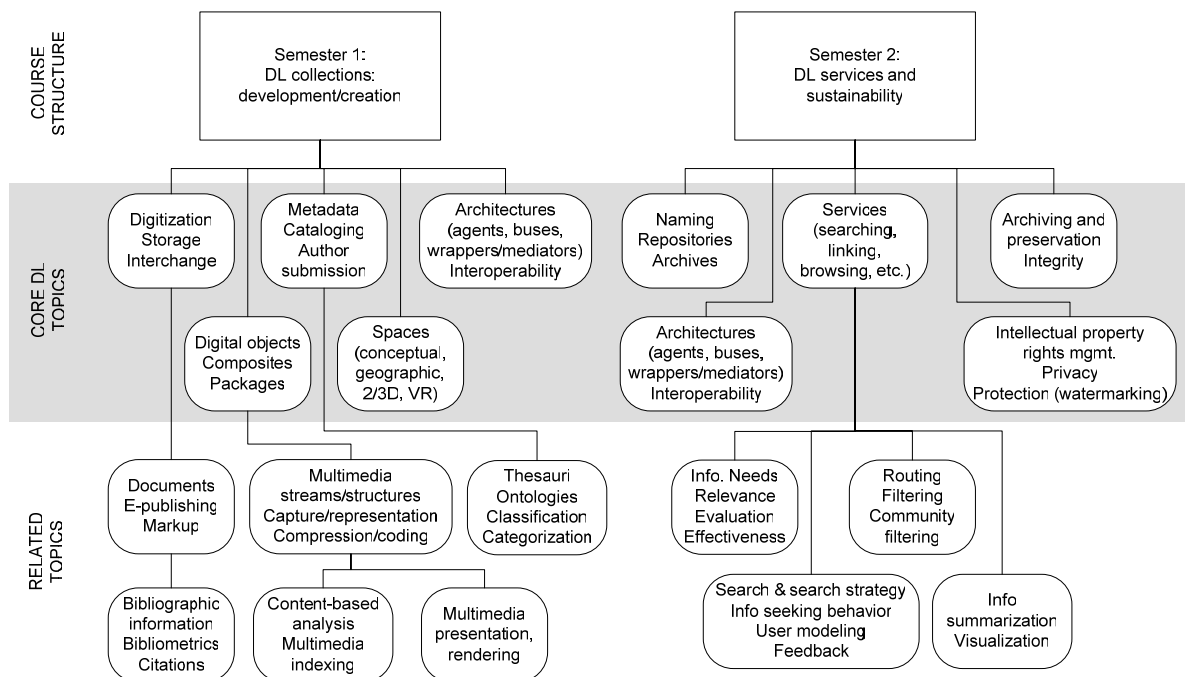


Figure 1. Curriculum framework

The topics listed in Figure 1 are based on a careful analysis of the CC2001 discussion regarding the field of Information Management (see Table 1 and [www.sigcse.org/cc2001/IM.html](http://www.sigcse.org/cc2001/IM.html)). We focused on the three core areas (IM1 – IM3), as well as the four areas most related to information (IM11 – IM14). The topics listed for these areas were considered, and those that cover core aspects of digital libraries, or are most related, are shown in the middle and bottom portions of Figure 1, respectively.

The question of how to incorporate the selected topics into actual courses has yet to be resolved, and is the focus of the proposed work. Some initial efforts to provide formal education in DLs is illustrated by the offerings of Virginia Tech (VT) and the University of North Carolina at Chapel

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Hill (UNC). The ways in which some of the relevant topics are currently covered in DL and DL-related courses in the curricula at these two institutions are listed in Table 2.

<b>Table 2. Mapping of Topics to Courses in CS and LIS</b>		
<b>CS Courses at VT</b>	<b>Topics</b>	<b>LIS Courses at UNC</b>
CS4624 Multimedia, Hyper-text, and Information Access; CS6604: Digital Libraries	Digitization, storage, and interchange	INLS 235: Digital Libraries: Principles and Applications; INLS 244: Digital Preservation and Access
CS4624; CS6604	Digital objects, composites, and packages	INLS 235
CS5604 Information Storage and Retrieval; CS6604	Metadata, cataloging, author submission	INLS 252: Metadata Architectures and Applications
CS6604	Naming, repositories, archives	INLS 145: Intro. to Archives and Records Mgmt; INLS 245: Adv. Issues and Practices in Archives and Manuscripts; INLS 254: Preservation of Library & Archive Materials
CS5604	Spaces (conceptual, geographical, 2/3D, VR)	INLS 281: Internet Issues and Future Initiatives
CS6604	Architectures (agents, buses, wrappers/mediators), interoperability	INLS 235
CS5604; CS6604	Services (searching, linking, browsing, and so forth)	INLS 150: Organization of Information; INLS 151: Organization of Materials I; INLS 235
CS6604	Intellectual property rights management, privacy, protection (watermarking)	INLS 105: Information Ethics
CS6604	Archiving and preservation, integrity	INLS 145; INLS 245; INLS 254

We will build upon the prior work with CC2001, related efforts [73-75], and our experiences at VT and UNC, as we work on DL curriculum development. However, it also is important to involve the DL community more broadly so as to ensure the intellectual merit and broad impact of our project. Accordingly we have asked key individuals (leading researchers, educators, and practitioners) in the DL area to serve on an Advisory Board, as is shown in Table 3 (next page). Further, we will involve a number of our colleagues at UNC and VT as experts to give advice on topics related to their individual specialties. The experts, including members of the Advisory Board, will assist with the identification of topics on which modules will be created, and will advise on the development of these modules. In particular, they will help us to define the scope of each topic and module and to determine which aspects of each topic are most relevant to particular curricular goals.

Educational modules will be developed (or adapted from those we find) in accordance with CC2001 guidelines. There is no similar curriculum document to CC2001 in the LIS field, but work is currently underway on developing internships, certificate programs, and post-Masters degree programs on digital librarianship under the Librarians for the 21st Century granting program of the Institute of Museum and Library Services. Four institutions are currently involved in this effort: the University of Illinois at Urbana-Champaign (UIUC), Indiana University at Bloomington, Syracuse University, and the University of Washington. As can be seen in Table 3,

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we will have advice from leading experts at these institutions. The proposed project will build on these institutions' efforts by identifying best practices in the internships and programs on digital librarianship offered by these institutions, and integrating these into the educational modules. These educational modules then will be provided to these institutions to implement in their courses. Feedback will allow iterative refinement of the courseware being prepared.

<b>Table 3. Experts (all have agree to assist)</b>		
<b>Advisory Board</b>	<b>VT</b>	<b>UNC</b>
Dan Atkins, U. Michigan Christine Borgman, UCLA Lillian Cassel, Villanova Michael Christel, CMU Raya Fidel, U. Washington Richard Furuta, Texas A&M University Elizabeth Liddy, Syracuse University Clifford Lynch, CNI Kurt Maly, ODU Javed Mostafa, Indiana Tefko Saracevic, Rutgers Linda Smith, UIUC	Steven Edwards, CS Roger Ehrich, CS Weiguo Fan, ACIS Steve Harrison, CS Gail McMillan, Library Chris North, CS Manuel Pérez-Quinónez, CS Naren Ramakrishnan, CS Deborah Tatar, CS Layne Watson, CS	Catherine Blake, SILS Laura Gasaway, Law School Jane Greenberg, SILS Stephanie Haas, SILS Brad Hemminger, SILS Thomas James, Dean, School of Education Paul Jones, Director, ibiblio; SILS & School of Journalism & Mass Communication Diane Kelly, SILS Gary Marchionini, SILS Montek Singh, CS Natasha Smith, Library Helen Tibbo, SILS Steve Weiss, CS

The module on Services, for example, will include coverage of both automated and human-intermediated services. Automated services include searching, linking, browsing, and other methods that can be instantiated in software, by which a user can interact with or manipulate data; human-intermediated services include digital reference, question answering, and other methods by which an intermediary can provide assistance to a user who interacts with data. This module will include topics such as policies and procedures for integrating human-intermediation into DL collections, and for integration of automation into traditionally human-intermediated services. This module will address both 1) the creation of "special collections" within a DL by creating sets of related links, and 2) issues involved in collecting and de-identifying answered questions.

Each module will be made up of a variety of materials, some of which we will discover and adapt. These will include lecture outlines, suggested readings for the students, and supplementary readings for faculty members adopting the modules. They might also include in-class or online exercises, case studies for stimulating class discussion or to be used as the basis for an assignment, and/or interactive software demonstrating key concepts. The modules will package all these components in a way that will provide coherent coverage of a particular topic.

The educational modules will themselves be modular, so that they can be implemented at various depths of coverage. The modules will be developed such that they can be implemented in their fullest form in some courses, and in scaled-down versions (i.e., as individual lessons) in other courses. The module on Information Visualization, for example, will include material on 3D representations, which will be important to address in full in CS courses, but which may be addressed only briefly in LIS courses. The module on Thesauri, for example, will include material on theories and approaches to classification, which will be important to address in full in LIS courses, but which may be addressed more briefly in CS courses. By designing these modules to be scalable, they will be accessible to a greater range of audiences in CS, LIS, and other programs.



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In addition, this effort will build upon educational research undertaken by many others. For example, plans for developing learning modules will build upon the original work by Keller on the Personalized System of Instruction [76], which has been integrated successfully into Fox's teaching at Virginia Tech for the last decade. Some materials will be developed through a constructivist approach [77]. Some will support laboratory based approaches [78, 79]. Concept maps developed will build upon work by Novak and others [80, 81], benefiting as well from results of the NSF-funded GetSmart project [82].

### 3. Development and Evaluation Process

Figure 2 summarizes the development and evaluation process for the project. The process will begin with the development/refinement of the overall vision/plan for the project, with input from the Advisory Board and the other sources cited in this proposal. These inputs will be analyzed in terms of curricular needs of the institutions represented on the Advisory Board, as well as the background of the students who might be interested in focusing on digital libraries in their studies. This analysis will occur within the context of the curricular specifications in CC2001.

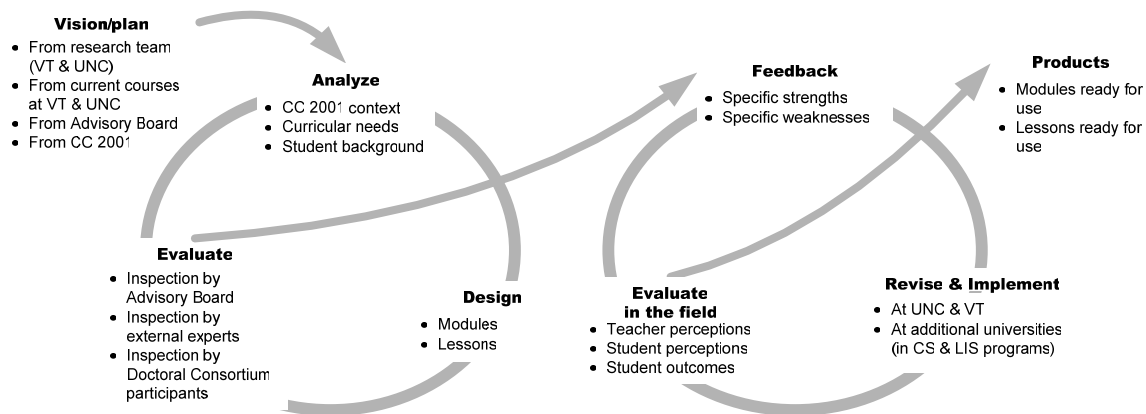


Figure 2. The development and evaluation process

Based on this analysis, modules supporting whole topics will be designed, as well as individual lessons supporting particular aspects of those topics. At least 6 modules, including separate lessons within those modules, will be designed during each year of the project.

As the design of a module/lesson is completed, a preliminary evaluation of it will be conducted. The primary criterion for evaluating the design of the modules is the learning of the students in the courses in which they are incorporated: Did the students gain the specified knowledge? Framed within the theoretical context of Bloom's taxonomy [83], we would expect that students learning about digital libraries from these modules would retain *knowledge* of specific terminology and facts, *comprehend* the meaning of important concepts presented, be able to *apply* their knowledge to realistic problems, be able to *analyze* the structure/relationships among the concepts presented, *synthesize* and apply their new knowledge to novel problems in digital libraries, and *evaluate* alternative approaches to particular aspects of digital libraries.

This framework will be applied to the modules/lessons by asking multiple external experts to inspect and evaluate each. In each case, the external experts will represent both CS and LIS perspectives on the module or lesson. We will identify evaluators from within the digital libraries research and teaching community who have particular expertise in the topic covered by the module. Each expert will be asked to inspect the module/lesson carefully, in terms of: 1) its coverage of the topic, 2) the currency and appropriateness of the readings undergirding the unit, and 3) any assignments or exercises associated with the unit, in relation to the level of Bloom's

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taxonomy [83] expected to be attained by the students. In addition to evaluating the unit, each expert will be asked for suggestions for improving the unit for use in CS and LIS courses. Each unit will be evaluated by at least five experts; their evaluations will be gathered via open-ended questionnaires or individual interviews. This is the first phase of a two-phase mixed-method evaluation approach outlined in Table 4.

This preliminary evaluation will occur early in the semester prior to implementation. Based on this evaluation, the suggested revisions will be made to each module's design.

During the next semester, one or more instructors will be asked to implement the module within the context of a course related to digital libraries. Much of this field testing will be carried out at Virginia Tech and UNC. However, other institutions also will be invited to participate in this field testing of the modules. The participating instructors will be asked to implement the modules as they are specified, with no undocumented additional customization, in order to gather evaluations of the units as specified by the research team.

<b>Table 4. Evaluation questions and data collection activities</b>					
<b>Evaluation questions</b>	<b>Data collection activities</b>				
	Content analysis	Open-ended questionnaires	Individual interviews	In-class student survey	Course assignments, tests, etc.
<b>Pre-implementation inspection by experts</b>					
Does the module adequately cover the topic?	X	X	X		
Are the assigned/suggested readings current and appropriate?	X	X	X		
Does the module address desired skills at the appropriate level of Bloom's taxonomy?	X	X	X		
<b>Post-implementation instructor perceptions</b>					
Did the module adequately cover the topic?		X	X		
Were the assigned/suggested readings current and appropriate?		X	X		
Did students display desired skills at the appropriate level of Bloom's taxonomy?		X	X		
<b>Post-implementation student perceptions</b>					
Were the module content and the readings interesting, useful, and challenging? Was the module structured appropriately?				X	
How much does the student feel he/she has learned from the module?				X	
What is the student's GPA? Anticipated course grade?				X	
<b>Post-implementation student performance</b>					
How did students perform on assessments of their learning of the module's content?					X

We will gather data from two sources during this second evaluation phase. The first source will be the teachers implementing the modules in their courses. The instructors will be interviewed individually, to maximize the richness of the data gathered. Based on their experiences, these teachers will be asked questions similar to those posed to the experts in the formative evaluation: 1) whether the unit adequately covered the topic, 2) whether the assigned/suggested readings were current and appropriate, and 3) which levels of Bloom's taxonomy [83] were addressed by

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the assignments and exercises associated with the unit. While the substance of this evaluation is parallel to that of the earlier evaluation, it will be based on the teacher's direct experience with implementation of the module/lesson, rather than on the expert's view unaided by direct experience.

The second source of data for this evaluation is the students who are learning from the modules and/or lessons. As data on student perceptions of the modules is gathered, the primary challenge is to disambiguate their perceptions of the modules from their perceptions of the instructor and the student-teacher interactions. Therefore, the standard end-of-course questionnaires typically used to evaluate instructor performance will *not* be used; instead, alternative methods, focusing on students' evaluations of the course content and their effort and learning in the course will be used. While a final selection of instrument has not been made, we expect to adopt a questionnaire similar to that proposed by Snare [84] or the student learning and student satisfaction scales suggested by McGorry [85]. Each student in the courses implementing the modules will be asked to fill out a questionnaire evaluating the unit immediately after its completion (when the student's memory of that specific unit within the course is clearest).

The data on teachers' and students' perceptions will be augmented by an examination of the students' performance related to the modules implemented. Teachers will not be asked to use any evaluation methods that they would not normally use, but they will be asked to share with us any assignments or tests completed in relation to the module(s) implemented. These performance results will be triangulated with the perceptual data in order to understand the learning outcomes resulting from the implementation of the modules.

Using these methods, 6 modules and their associated lessons will be evaluated in the field during year 2, and 6 more will be evaluated in the field during year 3.

In summary, both formative and summative evaluations of the modules developed as part of this project will be evaluated in a way that is consistent with the original recommendation of the 2001 Computing Curriculum [62, 63]:

“Some of the questions that should be asked during course assessment include the following...

- Has any important topic been omitted? Is anything unnecessarily included?
- Based on examination results and course evaluations, do students completing the course possess the desired skills, knowledge, and capabilities?
- Is the client... satisfied with our course offering? If not, what can we do to improve their satisfaction?” (p.71)

### **4. Project Management**

Project co-PIs will assume responsibility for module/lesson development according to Table 5 (next page). Fox, Pomerantz, and Wildemuth will have primary responsibility for developing the content of these educational modules. Members of the Advisory Board and invited experts will assist with the development of these modules, by advising the PIs with regard to their content. While less collaborative than the community-based approach used by the Connexions project at Rice (cnx.rice.edu), we will seek and use input for each module from a number of experts, and will collect additional comments in connection with all of our dissemination activities.

To coordinate our work, a number of listservs (and wikis, etc.) will be established (hosted at VT). They will include a project listserv, limited to the members of the research team; an Advisory Board listserv; and a listserv covering all the experts participating in the project. Communication among experts on topics related to the development of these modules will be conducted primarily through these listservs. The Advisory Board's discussions will be augmented with regular face to face meetings, held in conjunction with the JCDL and ASIS&T conferences.

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Graduate assistants (GAs) hired for this project will assist with the design and implementation of the modules/lessons. The GAs will be hired for their experience both with digital library development and instructional design, and will work closely with the PIs and the members of the Advisory Board.

Wildemuth will be responsible for coordinating the two evaluation phases of the project, collaborating with Fox and Pomerantz, with input from the Advisory Board. The graduate assistants will be directly involved in the evaluation data collection activities.

<b>Table 5. Key Personnel's Primary Responsibility for Module Topics</b>	
<b>Modules</b>	<b>Lead</b>
Digitization, storage, and interchange	Pomerantz
Digital objects, composites, and packages	Fox
Metadata, cataloging, author submission	Pomerantz
Spaces (conceptual, geographical, 2/3D, VR)	Fox
Architectures (agents, buses, wrappers/mediators), interoperability	Fox
Naming, repositories, archives	Pomerantz
Services (searching, linking, browsing, and so forth)	Pomerantz
Intellectual property rights management, privacy, protection (watermarking)	Wildemuth
Archiving and preservation, integrity	Fox
Documents, electronic publishing, markup, and markup languages	Pomerantz
Bibliographic information, bibliometrics, citations	Pomerantz
Multimedia streams/structures	Fox
Content-based analysis, multimedia indexing	Fox
Multimedia presentation, rendering	Fox
Thesauri, ontologies, classification and categorization, metadata	Pomerantz
Information needs, relevance, evaluation, effectiveness	Wildemuth
Search and search strategy, information seeking behavior, user modeling, feedback	Wildemuth
Routing, filtering, community filtering	Pomerantz
Information summarization and visualization	Fox

It should be noted that significant input as well as dissemination also will result from close connection with the leading related international conferences. Whenever possible, meetings of team members and experts, workshops, panels, papers, posters, and demonstrations will be arranged at: the ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL [86]), SIGIR (the annual conference of the ACM Special Interest Group on Information Retrieval, one of the sponsors of JCDL), the Annual Meeting of the American Society for Information Science and Technology (ASIS&T), the European Conference on Digital Libraries, and the International Conference on Asian Digital Libraries (ICADL). A small amount of funding for students attending the JCDL Doctoral Consortium is requested so that leading students of DL and their universities can assist in project activities.

PI Fox, serving as Chair of the IEEE-CS Technical Committee on Digital Libraries, appointed a group inside TCDL to work on Doctoral Consortia for JCDL and ECDL. This important effort to connect research and education in the DL area, which is starting in 2005, needs ongoing support so that a steady stream of PhDs in the DL area can attend the premiere annual meetings of the field, and be mentored in the middle of their doctoral work by leading DL experts. A condition of receiving NSF support when attending the JCDL Doctoral Consortium in 2006-2008 will be that those selected for the Seminar, as well as their advisor, provide feedback regarding our work on DL curriculum development. This will ensure that some of the best doctoral students in the area, and their more experienced advisors, will provide fresh insight and advice.

## *Collaborative Research: Curriculum Development: Digital Libraries*

Table 6 summarizes the activities of the project, setting them in a timeline that spans the 3 years of effort.

<b>Table 6. Project Timeline</b>									
<b>Activities</b>	<b>2006</b>			<b>2007</b>			<b>2008</b>		
	<b>Sp</b>	<b>Su</b>	<b>Fa</b>	<b>Sp</b>	<b>Su</b>	<b>Fa</b>	<b>Sp</b>	<b>Su</b>	<b>Fa</b>
Creation of an advisory board									
Engagement of experts to assist with module development									
Development of modules									
Development of lessons within modules									
Development of 1- and 2-semester courses									
Preliminary evaluation of modules and lessons by experts									
Revision of modules and lessons									
Implementation of modules and lessons in existing courses									
Evaluation of modules and lessons in the field									
Offering of new courses at UNC & VT									
JCDL conference and Doctoral Consortium									
ECDL & SIGIR conferences									
ASIS&T conference									
ICADL conference									

### **4.1. Key Staff**

**Edward Fox** of Virginia Tech is responsible for the overall management and leadership of the project. Fox is a long-time advocate and builder of digital libraries, and directs Virginia Tech's Digital Library Research Laboratory (DLRL), home to one of the larger and more productive DL student groups. His research team has developed technologies that relate to all aspects of digital libraries. His other primary technical interests include information storage and retrieval, multimedia and hypermedia technology, and computing education. Fox is director of CITIDEL, (see Section 6.1) which will help with project dissemination. Fox was co-PI on the NSF EHR/DUE award for the Computer Science Teaching Center (CSTC) and is co-editor of the ACM Journal on Educational Resources in Computing (JERIC [87, 88]). Fox is chair of the IEEE-CS Technical Committee on Digital Libraries. He is a past chair of SIGIR (Information Retrieval). He served as General Chair of the First ACM/IEEE-CS Joint Conference on Digital Libraries, and twice as program chair for ACM DL conferences. He was chair of the NSF-funded National Science Digital Library (NSDL) Policy Committee during its first two years. Fox has led work to connect digital libraries and graduate education since 1987, and is founder and Executive Director of the Networked Digital Library of Theses and Dissertations; he won the 1st Annual NDLTD Leadership Award in May 2004.

Fox has been chair or co-chair for over 30 conferences or workshops, and has been involved in over 200 other professional service activities. Fox is editor for the Morgan Kaufmann book series on Multimedia Information and Systems (which includes a number of works on information retrieval and multimedia as well as DLs; the book on DLs that he is preparing may fit into that series). Fox is co-author of over 250 publications plus 100 reports and other minor writings. He has given more than 50 keynote/distinguished/international invited presentations, and over 60 tutorials. Fox has been PI or co-PI on 90 funded research projects, and has been responsible for (parts of) implementations related to a wide variety of systems and services, including SMART

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[89], CODER [90], MARIAN [91-98], ENVISION [99-107], NCSTRL [108-111], CSTC [90, 112], CITIDEL, and NDLTD [90, 113-118].

Some of his curriculum related activities include:

- 2003- Member, College of Engineering Undergraduate Curriculum Committee (VT)
- 2003- Chair, Undergraduate Program Committee, Dept. of Computer Science (VT)
- 2001-2004, Member, National Visiting Committee, "Web-Network Technology Curriculum Development" NSF grant to Erie Community College and SUNY Buffalo
- 1998-2001 Member, Curriculum 2001 (CC2001) Review Committee (and member of focus group on Information Management)
- 1997 Chair: Education and Curriculum Development for Multimedia, Hypertext, and Information Access: Focus on Digital Libraries and Information Retrieval workshop
- 1997 Chair: Courseware, Education and Curriculum in Multimedia workshop
- 1996 Chair: Courseware, Training and Curriculum in Multimedia workshop
- 1996 Chair: Courseware, Training and Curriculum in Information Retrieval workshop
- 1996 Invited workshop presenter: IR Curriculum: Information Engineering to Digital Libraries
- 1995 Program committee member, Curriculum Development in Computer Information Science: A Framework for Developing a New Curriculum in IR, workshop following ACM SIGIR'95

**Barbara Wildemuth** of UNC is responsible for the project activities at UNC. She has both a formal education and significant professional experience related to two fields germane to this project: educational psychology and librarianship. After receiving her master's degree in library science in the mid-1970's, she worked in several roles in an ERIC Clearinghouse and a related special library. This allowed her to apply her formal background in librarianship to the ongoing development of an online database, as well as local library operations. During this period, she also gained expertise in research and evaluation methods, taking a second masters degree in educational psychology to increase her expertise in the content with which she was engaged: educational materials on research and evaluation methods.

Since joining the faculty in the School of Information and Library Science (SILS) at UNC, Wildemuth has pursued her long-term research interests in how people seek and use information, particularly when those behaviors are mediated by computers. Her research has included a number of studies of people using online databases and online library catalogs, as well as her current work with the Open Video project, a multimedia digital library developed with NSF support. Both Wildemuth and Pomerantz are active participants in UNC's Center for Research and Development of Digital Libraries (CRADLE, <http://ils.unc.edu/cradle/>).

While her research interests will help her to contribute to the substance of the modules and lessons to be developed, Wildemuth also can contribute through her experience as a teacher and a participant in the curriculum development process at UNC. She is the recipient of both national (ASIS&T) and UNC teaching awards. She has served on ASIS&T's Education Committee, as well as on UNC SILS' curriculum committees at the undergraduate, masters, and doctoral levels. She also currently serves as Associate Dean for Undergraduate Programs at SILS and Director of the Honors Program within the School.

**Jeffrey Pomerantz** of UNC received his master's degree in library and information science in 1997 and his Ph.D. in Information Transfer in 2003, and has been teaching in areas related to digital libraries since 1996. Pomerantz's research seeks the appropriate balance between automation and human-intermediated services in the various contexts of traditional and digital library

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environments. Much of Pomerantz's work has been in the arena of virtual reference services, and the integration of virtual reference services into digital library collections. He is a Research Scientist for the Information Institute of Syracuse (iis.syr.edu), and has been closely involved in the Institute's work on developing user services for the National Science Digital Library, in particular AskNSDL (nsdl.org/asknsdl/). He recently completed a program evaluation for the State Library of North Carolina of the State Library's new chat-based digital reference service, and is currently involved in several other evaluations of DL-related technologies as employed by "traditional" physical libraries. Pomerantz has been closely involved with the ongoing work to develop institutional repositories at UNC. Pomerantz's experience with DLs from the development, services, and instructional sides will enable him to contribute to the development of the modules as well as to work with the Advisory Board and instructors from both LIS and CS. His experience with evaluating library-related programs will enable him to contribute to the development of evaluation metrics and instruments.

### **5. A Theoretical Foundation – 5S**

We believe that the DL area will grow more rapidly if it has a firm theoretical foundation. Such a foundation could guide work on curricular and educational materials. Then, students would be less burdened by the current confusion in terminology or by ad hoc organizations of topics. Students should have an easier time organizing concepts in their own minds.

Toward that end, over the past six years, PI Fox and his students at Virginia Tech have been developing a formal model of digital libraries based on Streams, Structures, Spaces, Scenarios, and Societies, hereafter referred to as "5S" [119-123] (see Table 7). 5S captures the entities and medium involved in digital libraries. "Societies" describe both software "service managers" and fairly generic "actors" who could be (collaborating) human (users). "Scenarios" are specified as system states and events, but also can represent situations of use by human users (or machine processes, yielding services or transformations of data). "Spaces" cover 2D and 3D interfaces, GIS data, and representations of documents and queries. "Streams" describe all types of content (as well as communications and flows over networks, or into sensors, or sense perceptions), while "Structures" describe organizational schemes (including data structures, databases, and knowledge representations). 5S uses fundamental mathematical and computer science formalisms, such as sets and graphs. These formalisms are expressive enough to capture the significant aspects of the social, philosophical, technological, and economic/ethical elements that relate to DLs. The most complete description of this model is contained in Marcos Gonçalves' December 2004 doctoral dissertation [123], winner of a Sigma Xi award at Virginia Tech in April 2005.

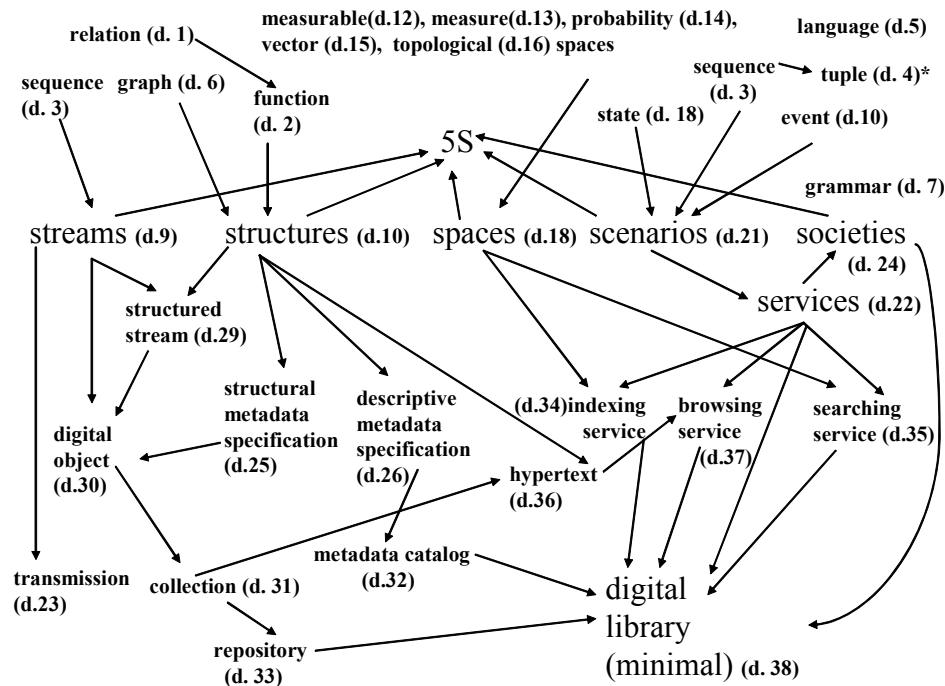
<b>Table 7. The 5 Ss</b>		
<b>Ss</b>	<b>Examples</b>	<b>Formalization</b>
Streams	Text; video; audio; image	Sequence (list)
Structures	Collection; catalog; hypertext; document; metadata	Graph, Function, Relation
Spaces	Used in indexing, browsing, and searching services – as well as interfaces	Set (vector, topological, measurable, measure, probability spaces)
Scenarios	Searching, browsing, recommending	States, events, sequences (lists)
Societies	Service managers (software), Actors (learners, teachers, etc.)	Tuple (relating events and actions)

Several practical tools have been developed within the 5S framework: a language called 5SL [124] which can be used to make formal specifications of a digital library, a tool for visualizing

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the model called 5SGraph [125] which can be used for visual semantic modeling of a DL, and a generator tool called 5SGen [126] which can be used for automatic generation of a componentized digital library [127]. 5S has been demonstrated to be highly efficient and effective in facilitating the development of DLs, such as in an NSF ITR funded project to prototype advanced approaches to handling archaeological site information [128, 129].

From a pedagogical perspective, 5S makes things precise and provides perspective. As can be seen in Figure 3, the 5Ss are defined (e.g., “stream” is explained in definition 9, i.e., d.9, in [122]) in terms of a small number of fundamental mathematical concepts (shown at the top of the figure). In turn, the 5Ss, individually or in combination, can be used to formally define each of the key objects (e.g., “digital object” – see d.30 in [122]) that are needed to define a minimal DL (see definition 38 in [122]). Building on this foundation, our subsequent work has shown how to formalize a DL ontology, and to specify all of the services found in a typical DL [123, 130].



**Figure 3. Definitional structure for a minimal DL [122]**

Further development on the model/theory will allow us to define critical dimensions and measures of DL quality. The formal and digital nature of DLs allows both precise definition of quality metrics and automatic assessment and enforcing of those quality properties. Table 8 shows example dimensions of quality and factors affecting the measurement of the corresponding quality metrics for those dimensions. If students studying about DLs can learn to think clearly about key DL concepts, and can develop systems and services that can be shown to be of high quality, there should be strong positive impact on DL education, development, and practice.

PI Fox, along with co-author Gonçalves, is preparing a textbook on digital libraries based on 5S. Unlike books by Lesk [9], Arms [11], or Borgman [131], for example, this work will rely on the 5S framework to ensure that it provides integrated coverage of the many concepts related to digital libraries. Fox and Gonçalves are focused on a book for teaching rather than reference; they will present DL tutorials based on their work in 2005 at JCDL, ECDL, and ACM SIGIR, clearly demonstrating community interest in this approach. As the DL community builds stronger foundations for the area, DL education should improve and have greater positive impact.



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Table 8. Examples of DL Quality Concepts, Dimensions, and Measures [123]		
DL Concept	Dimensions of Quality	Factors in Measuring
Digital Object	Accessibility Timeliness	Collection, no. of structured streams, rights management metadata, actor Storage time; creation time; modification time; access time
Structural Metadata Specification	Accuracy Completeness	Accurate attributes, no. of attributes in the record Missing attributes, schema size
Descriptive Metadata Specification	Appropriateness	Accuracy, Completeness, Conformance
Collection	Completeness Impact Factor	Collection size; size of the “ideal collection” Size of the collection; number of citations
Metadata Catalog	Completeness Validity	No. of digital objects without a metadata spec; size of the corresponding collection No. of invalid metadata specs; catalog size
Repository	Consistency	No. of collections in repository
Services	Consistency Effectiveness Reusability	Scenario paths; log entries Precision/recall (search); F1 measure (classification), etc. No. of reused services; no. of services in the DL; no of lines of code per service manager

### **6. Results from Prior NSF Support (of most closely related recent projects)**

**6.1 NSF Award Number:** DUE-0121679; Amount: \$835,000; Period: 9/15/2001 - 5/31/2005

**Title:** Computing and Information Technology Interactive Digital Educational Library (CITIDEL)

**PI:** Edward A. Fox; **Co-PIs:** Lillian Cassel, C. Lee Giles, John Impagliazzo, Deborah Knox, John A. N. Lee, Manuel Pérez-Quñones

CITIDEL [132] has been developed as part of the collection-building effort of the National Science Digital Library (NSDL) [133]. Essentially, it supports a large collection of metadata about resources stored at other sites, such as ACM Digital Library [134], IEEE-CS Digital Library [114], CiteSeer [135-138], DBLP [139], NCSTRL [108, 110, 140], NDLTD [117, 118, 141-144] (computing portion [118]), PlanetMath [145-147] (computing portion), etc., in addition to having a small collection in its own right. It has 16 source collections, and contains metadata on half a million resources. During the year 2003, it received an average of over 33,000 hits per month, by users from at least 22 countries. As the collection continues to grow [148], and interest in NSDL expands, CITIDEL should support a much wider base of users, especially undergraduates, and have significant impact on the teaching and learning of those interested in computing and information technology [117, 149-154].

Classification of CITIDEL resources [118] is uniquely suited to application in computing education. Visitors can find relevant materials with a search such as they might use in Google, but without many extraneous hits. Further, CITIDEL users have the ability to browse the collection in the context of a particular course need [155]. This is accomplished by using the

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field definition represented by the Body of Knowledge (BoK) from the Computing Curriculum 2001 report.

Within CITIDEL, the BoK from the computer science volume has been used to index resources in the collection. As a result, a visitor can move through this definition of computer science topic areas to find a particular interest, perhaps a course or a module within a course. When the visitor arrives at the topic of interest, CITIDEL displays indexed items from the collection. Thus, the resources available in the collection are particularly accessible for use in curriculum development and course support [155].

The CITIDEL project has exploited *the potential of information technologies and digital library research to create and support rich learning environments*. Built at the Virginia Tech Digital Library Research Laboratory (DLRL) [156], CITIDEL incorporates the most recent DL technologies and information management research [118, 157-161]. The entire system is built of components extending ideas of the OAI Protocol [127, 162-166], allowing easy introduction of new components as needed, and replacement of others. The project has incorporated the XML Log Standard for Digital Libraries [167, 168], developed at DLRL, which provides a comprehensive record of user access and interaction with the system.

**6.2 NSF Award Number:** IIS 0099538; Amount: \$518,855; Period: 6/1/2001-4/30/2004

**Title:** Agile Views for Video Browsing: Advanced Surrogates, Control Mechanisms and Usability

**PI:** Gary Marchionini; **Co-PI:** Barbara Wildemuth

The Open Video Project [169] received NSF support in 2001 to investigate how digital video might be represented by surrogates, how users can manipulate these surrogates in an interactive, agile view interface, and the methods by which the effectiveness of the surrogates could be evaluated. The results to date may be grouped into three areas: extension and evaluation of the Open Video Repository and its user interface extension; evaluation of the agile views design framework; and a set of nine user studies related to those evaluations that entailed the development of a set of evaluation procedures and metrics and that highlighted the need for research in effort-outcome tradeoffs [170-178].

The Open Video repository now provides access to 2000 digital video segments (approximately half a terabyte of content) in MPEG-1, MPEG-2, MPEG-4, and QuickTime formats. In the Sep.-Nov. 2003 period, the Open Video site ([www.open-video.org](http://www.open-video.org)) received more than five million hits and served more than 60,000 unique visitors. Thus, the Open Video Repository not only serves as a test bed for our interaction design research, it also is a popular resource for the research and educational communities.

The agile views design framework [170, 171] incorporates both overviews of the collection and previews of particular items in the collection, as well as shared views. As part of his dissertation research completed with NSF support, Geisler [170] conducted user evaluations of the different agile views. His work validated the agile views design framework and, along with other user studies, was the basis for a complete redesign of the Open Video interface that was released in August of 2003.

A series of user studies was conducted to increase our understanding of how people retrieve and interact with digital videos. A preliminary study [175] examined the efficacy of several surrogates, followed up with further investigation of the fast forward surrogate [177], all using six new performance measures developed by the Open Video Project team [174, 178]. These early studies focused on specific aspects of people's interactions with video and video surrogates; later studies (such as our participation in TRECVID 2003 [176]) investigated broader streams of user

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interactions. The interplay among these results is particularly important as the results of the first two years' studies were instrumental in redesigning the user interface, which has received kudos in several WWW (e.g., Yahoo) and popular press (e.g., New York Times) quarters and was recently honored as a ComputerWorld laureate. We take these results as evidence that user studies do lead to better operational designs.

### **7. Impact**

It is expected that the effort supported by this grant will have a strong positive impact nationwide on the education of the next generation of digital librarians and DL developers. The courses, modules, and lessons developed over the next three years will provide a firm foundation for digital library education in both CS and LIS programs. Eighteen or more modules, each made up of several separable lessons, and structured in a way that they can be formed into coherent courses, will provide educators with a strong basis for locally-customized curricula in digital libraries. Dissemination of these modules through the NSF-funded CITIDEL project, and thence through the National Science Digital Library, will help expand their adoption by teachers and students. The participation of a large number of experts in the development and evaluation of these materials will help to speed further their dissemination into the leading schools in the U.S.A. and, through the work of graduates of those schools, as well as those connected with the annual JCDL-connected Doctoral Consortium, will yield benefits very quickly in the development and management of digital libraries and the provision of digital library services. More broadly, this effort should help advance the DL area by ensuring a firm foundation and basis of understanding for all involved in learning, teaching, and R&D.

### **8. Conclusion**

Thus, in summary, there is need; curriculum and module development should yield important outcomes; the PIs are qualified to undertake the proposed work; there is excellent support from the PIs' home institutions; and significant impact is expected in the information management area [179] and in US economic development in this key area [180, 181].

It is fitting to close this proposal with a series of quotes from the 2003 NSF-sponsored workshop on DL research directions [66]:

- "Future research aims to develop an integrative theory." (p. 4)
- "Without machines, the scope and effectiveness of human search would be severely constrained. The challenge, however, is to envision, create, and assess ways in which machines can support this human activity, leading to retrieval of information that includes traditional and multimedia data (text, audio, images, and video), but extends further ..." (p. 9)
- "Ultimately, digital libraries will offer unparalleled access to information for a far broader range of users than existing physical and organizational structures." (p. 13)
- "It is clear that digital libraries and the knowledge made available therein have immense potential to contribute to issues of national priority." (p. 26)

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### ***Collaborative Research: Curriculum Development: Digital Libraries***

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- [165] H. Suleman and E. A. Fox, "Designing Protocols in Support of Digital Library Componentization," in *Proceedings of the 6th European Conference on Research and Advanced Technology for Digital Libraries (ECDL2002)*. Rome, Italy, 2002.
- [166] H. Suleman, E. A. Fox, R. Kelapure, A. Krowne, and M. Luo, "Building digital libraries from simple building blocks," *Online Information Review*, vol. 27, pp. 301-310, 2003.  
<http://oberon.emeraldinsight.com/vl=1389995/cl=44/nw=1/rpsv/cgi-bin/linker?ini=emerald&reqidx=/cw/mcb/14684527/v27n5/s1/p301>
- [167] M. A. Gonçalves, M. Luo, R. Shen, M. Farooq, and E. A. Fox, "An XML Log Standard and Tool for Digital Library Logging Analysis," presented at Sixth European Conference on Research and Advanced Technology for Digital Libraries, Rome, Italy, 2002.
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- [170] G. Geisler, *AgileViews: A Framework for Creating More Effective Information Seeking Interfaces*. Chapel Hill, NC: Unpublished doctoral dissertation at University of North Carolina at Chapel Hill, 2003.
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- [173] G. Geisler, G. Marchionini, M. Nelson, R. Spinks, and M. Yang, "Interface concepts for the Open Video Project," in *Proceedings of the 2001 ASIST Annual Meeting*, 38, 2001, pp. 58-75.
- [174] M. Yang, B. M. Wildemuth, G. Marchionini, T. Wilkens, G. Geisler, A. Hughes, R. Gruss, and C. Webster, "Measuring user performance during interactions with digital video collections," in *Proceedings of the 66th Annual Meeting of the American Society for Information Science and Technology (ASIST 2003)*, 40, 2003, pp. 3-11.
- [175] B. M. Wildemuth, G. Marchionini, T. Wilkens, M. Yang, G. Geisler, B. Fowler, A. Hughes, and X. Mu, "Alternative surrogates for video objects in a digital library: users' perspectives on their relative usability," in *Proceedings of the*

## ***Collaborative Research: Curriculum Development: Digital Libraries***

- European Conference on Digital Libraries (ECDL), Milan, Italy, September, 2002, 2002.* <http://www.open-video.org/ovadmin/ECDL2002.020620.pdf>
- [176] B. M. Wildemuth, M. Yang, A. Hughes, R. Gruss, G. Geisler, and G. Marchionini, "Access via Features versus Access via Transcripts: User Performance and Satisfaction," University of North Carolina, School of Information and Library Science, Chapel Hill, NC SILS TR-2003-05, 2003. <http://ils.unc.edu/ils/research/reports/TR-2003-05.pdf>
- [177] B. M. Wildemuth, G. Marchionini, M. Yang, G. Geisler, T. Wilkens, A. Hughes, and R. Gruss, "How fast is too fast? Evaluating fast forward surrogates for digital video," in *Proceedings of the ACM/IEEE Joint Conference on Digital Libraries, Houston, May 2003. Winner of the Vannevar Bush Award for Best Paper, 2003.* <http://www.open-video.org/ovadmin/p221-wildemuth.pdf>
- [178] M. Yang, B. M. Wildemuth, G. Marchionini, T. Wilkens, G. Geisler, A. Hughes, R. Gruss, and C. Webster, "Measures of User Performance in Video Retrieval Research," University of North Carolina, School of Information and Library Science, Chapel Hill, NC SILS Technical Report 2003-02, 2003. <http://www.ils.unc.edu/ils/research/TR-2003-02.pdf>
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- [181] M. Castells, *The Information Age: Economy, Society, and Culture. Volume II: The Rise of the Network Society*. Oxford: Blackwell, 1997.



## **EDWARD A. FOX**

(fox@vt.edu, <http://fox.cs.vt.edu/>)

### **A. CV: EDUCATION:**

8/83 Ph.D. Computer Science, Cornell University  
1/81 M.S. Computer Science, Cornell University  
2/72 B.S. Electrical Engineering (Computer Science Option), M.I.T.

### **CURRENT/RECENT EMPLOYMENT:**

1/98- Director, Digital Library Research Laboratory, VPI&SU (Virginia Tech)  
4/95- Professor, Dept. of Computer Science, VPI&SU (Virginia Tech),  
660 McBryde Hall, Blacksburg VA 24061-0106 USA  
6/90-12/02 Associate Director for Research, VPI&SU (Virginia Tech) Computing Center  
5/88-4/95 Associate Professor, Dept. of Computer Science, VPI&SU  
9/83-5/88 Assistant Professor, Dept. of Computer Science  
Virginia Polytechnic Institute and State University

### **PROFESSIONAL SERVICE:**

#### **CURRENT (Selected):**

Chairman, IEEE Technical Committee on Digital Libraries, IEEE Computer Society ([www.ieee-tcdl.org](http://www.ieee-tcdl.org))  
Executive Director, Networked Digital Library of Theses and Dissertations ([www.ndltd.org](http://www.ndltd.org))  
Director, Computing and Information Technology Interactive Digital Educational Library (CITIDEL, an NSDL collection project launched fall 2001, [www.citidel.org](http://www.citidel.org))  
Co-Editor-in-Chief, ACM J. of Educational Resources in Computing (JERIC, [www.acm.org/pubs/jeric](http://www.acm.org/pubs/jeric))  
Co-Principal Investigator, Computer Science Teaching Center ([www.cstc.org](http://www.cstc.org))  
Program co-chair ICADL2005; Panel co-chair ECDL2005; Program committee member CIKM2005, JCDL2005, ...  
Member: DELOS Advisory Board; D-Lib Forum Advisory Board; ICADL Steering Committee; JCDL Steering Committee; PNNL Lab Adv. Committee; ...  
Editor, Morgan Kaufmann Publishers, Inc. Series on Multimedia Info. and Systems  
Editorial boards: ACM Trans. on Information Systems, Electronic Publishing - Origination, Dissemination and Design J.; IMEJ of Computer-Enhanced Learning; Info. Processing & Management; Int. J. on Digital Libraries; J. Educational Multimedia and Hypermedia; Journal for Universal Computer Science; Multimedia Tools and Applications

#### **RECENT (Selected):**

Chair, NSDL Policy Committee (2002-2003, continuing through 2004 as member)  
Chair, First Joint ACM/IEEE-CS Conference on Digital Libraries (JCDL'2001, [www.jcdl.org](http://www.jcdl.org))  
Program chair, 1999 Virginia Internet Week, Blacksburg, VA, September 13-17, 1999  
Program chair, ACM Digital Libraries '99, Berkeley CA, August 11-14, 1999  
Program chair, ACM Digital Libraries '96, Bethesda MD, 3/20-23/96; SIGIR '95, Seattle, WA, 1995  
Member: OCLC Research Advisory Council; NCSTRL working group ([www.ncstrl.org](http://www.ncstrl.org))  
Chair, ACM SIGIR (Special Interest Group on Information Retrieval), 1991-95  
Vice Chair, ACM SIGIR (Special Interest Group on Information Retrieval), 1987-91  
Editor-in-chief ACM Press Database and Electronic Products, 1988-91  
Founder/Chair ACM: DL Conf. Steering Comm., 1995-98; Multimedia Conf. Steering Comm., 1992-94  
Program committee member: ACM DL '96-00; ACM Multimedia '93-96, 98-99; ACM SIGIR '89-01; ASIS 1999 Midyear; CIKM'99; ECDL'2001; ICON'99; ICSC'99; MIS'99; SPIRE'01; ...

**GRANTS/CONTRACTS:** Over 85 proposals funded for over \$13M since 1983

**TUTORIALS:** Over 60: digital libraries, hypertext, information retrieval, multimedia, ...

**ORAL PRESENTATIONS:** Over 250 besides those with publications

## **B. PUBLICATIONS (over 260, including):**

### **PUBLICATIONS (Selected Related):**

- Weiguo Fan, Edward A. Fox, Praveen Pathak, and Harris Wu. The effects of fitness functions on genetic programming-based ranking discovery for web search, *Journal of the American Society for Information Science and Technology (JASIST)*, 2004, 55(7): 628-636
- B. Zhang, M.A. Gonçalves, W. Fan, Y. Chen, E.A. Fox, P. Calado, and M. Cristo. Combining Structural and Citation-Based Evidence for Text Classification. In: *CIKM 2004, Washington D.C. Proc. of the 13th Conf. on Information and Knowledge Management*, Nov. 8-13. ACM Press, 2004
- Fan, W., Luo, M., Wang, L., Xi, W., and Fox, E. A. Tuning before feedback: Combining ranking discovery and blind feedback for robust retrieval. *SIGIR 2004, 27th Annual International ACM SIGIR Conference on R&D in Information Retrieval*, Sheffield, England, 25-29 July
- Weiguo Fan; Gordon, M.D.; Pathak, P.; Wensi Xi; Fox, E.A.; Ranking function optimization for effective web search by genetic programming: an empirical study, in the *Proceedings of 37th Hawaii International Conference on System Sciences (HICSS)*, 5-8 Jan. 2004, 105 – 112
- Li Wang, Weiguo Fan, Rui Yang, Wensi Xi, Ming Luo, Ye Zhou, Edward A. Fox, Ranking Function Discovery by Genetic Programming for Robust Retrieval, *Text Retrieval Evaluation Conference-2003*, Nov 17-23, NIST, Washington DC, 9 pages

### **PUBLICATIONS (Selected Other):**

- W. Xi, B. Zhang, Z. Chen, Y. Lu, S. Yan, W.Y. Ma, E.A. Fox. "Link Fusion: A Unified Link Analysis Framework for Multi-type Inter-related Data Objects". In *Procs. WWW2004, New York, U.S.A.* 19-22 May 2004, 10 pages
- Unni Ravindranathan, Rao Shen, Marcos André Gonçalves, Weiguo Fan, Edward A. Fox, and James W. Flanagan. Prototyping Digital Libraries Handling Heterogeneous Data Sources - The ETANA-DL Case Study. In *Research and Advanced Technology for Digital Libraries: Proc. 8th European Conf., ECDL 2004, Bath, UK, September 12-17, 2004*, eds. Rachel Heery and Liz Lyon, *Lecture Notes in Computer Science*, vol. 3232, Springer-Verlag GmbH, Berlin, 186-197
- U. Ravindranathan, R. Shen, M. A. Gonçalves, W. Fan, E. A. Fox, and J. W. Flanagan, ETANA-DL: A Digital Library for Integrated Handling of Heterogeneous Archaeological Data. In *Proc. Fourth ACM/IEEE Jt. Conf. on Digital Libraries, JCDL2004, Tucson, AZ, June 7-11, 2004*, 76-77.
- N. J. Belkin, P. Kantor, E. A. Fox and J. A. Shaw. Combining the Evidence of Multiple Query Representations for Information Retrieval. *Info. Proc. & Mgmt.*, 31(3), 431-448, May-June 1995.
- J. Shaw and E. Fox. Combination of Multiple Searches. In *3rd Text REtrieval Conf. (TREC-3)*, National Institute of Standards and Technology Special Publication, 500-225, April 1995, ed. D. Harman.

## **C. SELECTED COLLABORATORS IN RECENT YEARS (see also D below):**

H. Anan, A. Atkins, P. Calado, L. Cassel, V. Chachra, H. Chen, S. Chen, Z. Chen, J. Eaton, W. Fan, J. Flanagan, J. French, J. Frumkin, J. Futrelle, D. Garza-Salazar, R. Gaur, P. Gherman, C. Giles, H. Gladney, M. Gordon, M. Halbert, H. Han, E. Hilf, E. Hoffman, J. Impagliazzo, S. Kim, D. Knox, A. Laender, J. Lage, A. Lally, J. Lee, R. Larsen, X. Liu, E. Logan, Y. Lu, W.Y. Ma, D. Madali, K. Maly, E. Manavogly, B. Marshall, G. McMillan, C. Medeiros, R. Moore, J. Moxley, S. Myaeng, M. Nelson, C. North, L. Nowell, P. Pathak, M. Perez, N. Ramakrishnan, B. Ribeiro-Neto, D. Reis, P. Roberto, J.A. Sanchez, T. Severiens, C. Shaffer, P. Shires, A. S. da Silva, J. Shu, O. Sornil, M. Suthers-McCabe, R. Tan, L. Tinoco, S. Urs, M. Vieira, L. Watson, C. Weissner, H. Wu, L. Xu, S. Yan, H. Zha, Y. Zhang, Z. Zhang, M. Zubair

## **D. SELECTED GRADUATE STUDENTS IN RECENT YEARS (among scores):**

A. Agrawal, M. Ali, S. Angle, A. Bazaz, Y. Chen, F. Das Neves, S. Feizbadi, K. Garach, M. Gonçalves, N. Kampanya, R. Kelapure, S. Kim, N. Kipp, M. Kothapalli, A. Krowne, M. Luo, P. Mather, K. McDevitt, A. Pande, G. Panchanathan, S. Perugini, A. Prabhune, U. Ravindranathan, J. R. Richardson, R. Shen, P. Shivakumar, O. Sornil, M. Subhas, H. Suleman, R. da S. Torres, J. Wang, L. Wang, C. Williams, W. Xi, R. Yang, B. Zhang, Y. Zhou, Q. Zhu

## **E. OWN ADVISOR: G. Salton (deceased)**

## BIOGRAPHICAL SKETCH

### BARBARA MARIE WILDEMUTH

School of Information and Library Science, University of North Carolina at Chapel Hill  
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#### PROFESSIONAL PREPARATION

North Central College, Naperville, IL	Music Education: Piano	1971, B.Mus.Ed.
University of Illinois, Urbana, IL	Library Science	1976, M.L.S.
Rutgers University, New Brunswick, NJ	Ed. Statistics & Measurement	1982, M.Ed.
Drexel University, Philadelphia, PA	Info. Sys. Design & Evaluation	1989, Ph.D.

#### APPOINTMENTS

1988-Present	Frances Carroll McColl Professor and Associate Dean for Undergraduate Programs, School of Information and Library Science, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina (1988-1989, Instructor; 1989-1996, Assistant Professor; 1996-2003; Adjunct Appt. in Dept. of Biomedical Engineering, School of Medicine, UNC-CH; 1996-2000, Associate Professor; 2000-present, Professor; 2002-present, Associate Dean; 2004-present, McColl Professor)
1985-1988	Teaching Assistant, College of Information Studies, Drexel University, Philadelphia, Pennsylvania
1979-1985	Associate Director, ERIC Clearinghouse on Tests, Measurement, and Evaluation, Educational Testing Service, Princeton, New Jersey
1978-1979	Head, Test Collection, Educational Testing Service, Princeton, New Jersey
1976-1978	Indexer/Abstractor and User Services Coordinator, ERIC Clearinghouse on Tests, Measurement, and Evaluation, Educational Testing Service, Princeton, New Jersey

#### PUBLICATIONS MOST CLOSELY RELATED TO THE PROPOSAL

Wildemuth, B. M. (2004). The effects of domain knowledge on search tactic formulation. *Journal of the American Society for Information Science & Technology*, 55(3), 246-258.

Hughes, A., Wilkens, T., Wildemuth, B., & Marchionini, G. (2003). Text or pictures? An eyetracking study of how people view digital video surrogates. *Proceedings of the International Conference on Image and Video Retrieval (CIVR), University of Illinois at Urbana-Champaign, July 24-25, 2003*, 271-280. [http://www.open-video.org/ovadmin/hughes\\_civr\\_2003.pdf](http://www.open-video.org/ovadmin/hughes_civr_2003.pdf). Also published as *Lecture Notes in Computer Science*, 2728, 271-280.

Yang, M., Wildemuth, B. M., Marchionini, G., Wilkens, T., Geisler, G., Hughes, A., Gruss, R., & Webster, C. (2003). Measuring user performance during interactions with digital video collections. *ASIST 2003: Proceedings of the 66<sup>th</sup> ASIST Annual Meeting, Volume 40*. Medford, NJ: Information Today, for the American Society for Information Science & Technology, 3-11. [http://www.open-video.org/papers/ASIST2003\\_yang.pdf](http://www.open-video.org/papers/ASIST2003_yang.pdf).

**CLOSELY RELATED PUBLICATIONS, *continued***

- Wildemuth, B. M., Marchionini, G., Yang, M., Geisler, G., Wilkens, T., Hughes, A., & Gruss, R. (2003). How fast is too fast? Evaluating fast forward surrogates for digital video. Paper presented at the ACM/IEEE Joint Conference on Digital Libraries, Houston, May 2003. <http://www.open-video.org/papers/p221-wildemuth.pdf>. Winner of the Vannevar Bush Award for Best Paper.
- Wildemuth, B. M., Marchionini, G., Wilkens, T., Yang, M., Geisler, G., Fowler, B., Hughes, A., & Mu, X. (2002). Alternative surrogates for video objects in a digital library: users' perspectives on their relative usability. Presented at the European Conference on Digital Libraries (ECDL), Milan, Italy, September, 2002. <http://www.open-video.org/papers/ECDL2002.020620.pdf>.

**ADDITIONAL SELECTED PUBLICATIONS**

- Wildemuth, B. M., & Hughes, A. (In press, 2005). Perspectives on the tasks in which information behaviors are embedded. In Fisher, K E., Erdelez, S., & McKechnie, E. F. (Eds.). *Theories of Information Behavior: A Researcher's Guide*. Medford, NJ: Information Today. 7p.
- Wildemuth, B. M., Yang, M., Hughes, A., Gruss, R., Geisler, G., & Marchionini, G. (2003). *Access via Features versus Access via Transcripts: User Performance and Satisfaction. TREC VID 2003 Notebook Paper. SILS Technical Report 2003-05*. Chapel Hill: University of North Carolina, School of Information and Library Science, Technical Report Series. <http://ils.unc.edu/ils/research/reports/TR-2003-05.pdf>.
- Wilkens, T., Hughes, A., Wildemuth, B. M., & Marchionini, G. (2003). The role of narrative in understanding digital video: an exploratory analysis. *ASIST 2003: Proceedings of the 66<sup>th</sup> ASIST Annual Meeting, Volume 40*. Medford, NJ: Information Today, for the American Society for Information Science & Technology, 323-329. [http://www.open-video.org/papers/Wilkens\\_Asist\\_2003.pdf](http://www.open-video.org/papers/Wilkens_Asist_2003.pdf).
- Wildemuth, B. M., de Bliet, R., Friedman, C. P., Keyes, J., & Downs, S. M. (2000). A longitudinal study of database-assisted problem solving. *Information Processing & Management*, 36, 445-459.
- Wildemuth, B. M., & Moore, M. E. (1995). End-user search behaviors and their relationship to search effectiveness. *Bulletin of the Medical Library Association*, 83, 294-304.

**COLLABORATORS**

Jennifer Arbanas, Duke University  
 Walter Bollenbacher, Biology, UNC-CH  
 Alice Boyington, Nursing, UNC-CH  
 Marci Campbell, Public Health, UNC-CH  
 M.C. Dougherty, Nursing, UNC-CH  
 Claudia Gollop, SILS, UNC-CH  
 Pamela Haines, Public Health, UNC-CH  
 Victor Hasselblad, Duke University  
 Michelle Hayslett, NC State University  
 Laura Linnan, Public Health, UNC-CH

David Lobach, Duke University  
 Gary Marchionini, SILS, UNC-CH  
 D. D. Mishra, Duke University  
 Xiangming Mu, Univ. of Wisconsin, Milwaukee  
 Kurt Ribisl, Public Health, UNC-CH  
 Diane Sonnenwald, Göteborg University &  
 University College of Borås  
 Lisa Sutherland, Public Health, UNC-CH

**DOCTORAL ADVISOR**

Belver Griffith, Drexel University (deceased)

**DOCTORAL STUDENTS ADVISED SINCE 2000**

Bin Li, Wayne State University (beginning August 2005)  
 Karen O'Keefe, North Carolina State Library

## Jeffrey Pomerantz

### Education

Ph.D.	2003	School of Information Studies, Syracuse University
M.S. (L.I.S.)	1997	Graduate School of Library & Information Science, Simmons College
B.A.	1993	Department of Communication, University of Massachusetts at Amherst

### Appointments

2003 – Present	Assistant Professor School of Information and Library Science University of North Carolina at Chapel Hill
1997 – 1998	Technical Coordinator of Microcomputer Labs Simmons College Libraries
1995 – 1997	Manager of Information Technology Graduate School of Library & Information Science, Simmons College

### Publications related to this proposal

Pomerantz, J. (2005). A Linguistic Analysis of Question Taxonomies. *Journal of the American Society for Information Science and Technology*. 56(7), 715-728.

Pomerantz, J. (2003). Integrating Digital Reference Service into the Digital Library Environment. In R. D. Lankes & S. Nicholson & A. Goodrum (Eds.), *The Digital Reference Research Agenda*. Chicago: Association of College and Research Libraries.

Pomerantz, J., Nicholson, S., Belanger, Y., & Lankes, R. D. (2004). The Current State of Digital Reference: Validation of a General Digital Reference Model through a Survey of Digital Reference Services. *Information Processing & Management*, 40(2), 347-363.

Pomerantz, J., Nicholson, S., & Lankes, R. D. (2003). Digital Reference Triage: Factors Influencing Question Routing and Assignment. *The Library Quarterly*, 73(2), 103-120.

Lankes, R. D., McClure, C. R., Gross, M., & Pomerantz, J. (Eds.). (2003). *Implementing Digital Reference Services: Setting Standards and Making it Real*. New York: Neal-Schuman Publishers, Inc.

## Other significant publications

Pomerantz, J. (2005). A Linguistic Analysis of Question Taxonomies. *Journal of the American Society for Information Science and Technology*, 56(7), 715-728.

Lavender, K., Nicholson, S., & Pomerantz, J. (2005). Building Bridges for Collaborative Digital Reference between Libraries and Museums through an Examination of Reference in Special Collections. *Journal of Academic Librarianship*, 30(2).

Pomerantz, J. (2004). Factors Influencing Digital Reference Triage: A Think-Aloud Study. *The Library Quarterly*, 74(3), 235-264.

Peek, R. P., & Pomerantz, J. P. (1998). Electronic Scholarly Journal Publishing. In M. E. Williams (Ed.), *Annual Review of Information Science and Technology* (Vol. 33, pp. 321-356). Medford, NJ: Information Today, Inc.

Peek, R., Pomerantz, J., & Paling, S. (1998). The Traditional Scholarly Journal Publishers Legitimize the Web. *Journal of the American Society for Information Science*, 49(11), 983-989.

## Synergistic Activities

- |             |   |
|-------------|---|
| 2003 – 2005 | “Evaluation of the State Library of North Carolina’s Statewide Virtual Reference Service”   |
| 2002 – 2004 | “Question Triage for Experts and Documents: Expanding the Information Retrieval Function of the NSDL”<br>NSF grant number 0226144 |
| 2001 – 2003 | “Integrating Expertise into the NSDL: Putting a Human Face on the Digital Library”<br>NSF grant number 0121525                    |

## Recent Co-authors and Co-editors

Yvonne Belanger, Center for Instructional Technology, Duke University  
Melissa Gross, College of Information, Florida State University  
R. David Lankes, School of Information Studies, Syracuse University  
Kenneth Lavender, School of Information Studies, Syracuse University  
Lili Luo, School of Information and Library Science, University of North Carolina at Chapel Hill  
Charles R. McClure, College of Information, Florida State University  
Scott Nicholson, School of Information Studies, Syracuse University

**Ph.D. Advisor:** Elizabeth D. Liddy, School of Information Studies, Syracuse University

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION				FOR NSF USE ONLY		
<b>Virginia Polytechnic Institute and State University</b>				PROPOSAL NO.		DURATION (months)
						Proposed
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Edward A Fox</b>				AWARD NO.		
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. <b>Edward A Fox - Professor</b>				1.00	0.00	0.00
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				1.00	0.00	0.00
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00
3. ( 1 ) GRADUATE STUDENTS						20,605
4. ( 0 ) UNDERGRADUATE STUDENTS						0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6. ( 0 ) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						33,591
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						5,702
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						39,293
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
<b>Computer for GRA</b>				\$	2,000	
TOTAL EQUIPMENT						2,000
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						1,700
2. FOREIGN						500
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ _____						0
2. TRAVEL _____						8,000
3. SUBSISTENCE _____						2,000
4. OTHER _____						0
TOTAL NUMBER OF PARTICIPANTS ( 10 ) TOTAL PARTICIPANT COSTS						10,000
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						1,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						7,167
TOTAL OTHER DIRECT COSTS						8,167
H. TOTAL DIRECT COSTS (A THROUGH G)						61,660
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
<b>All less equipment, tuition (G6) (Rate: 51.0000, Base: 52493)</b>						
TOTAL INDIRECT COSTS (F&A)						26,771
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						88,431
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						\$ 88,431 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME				FOR NSF USE ONLY		
<b>Edward A Fox</b>				INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG
<b>Ross verbrugge</b>						

1 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535057

# SUMMARY PROPOSAL BUDGET

YEAR 2

ORGANIZATION				FOR NSF USE ONLY		
<b>Virginia Polytechnic Institute and State University</b>				PROPOSAL NO.		DURATION (months)
						Proposed
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Edward A Fox</b>				AWARD NO.		
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. <b>Edward A Fox - Professor</b>				1.00	0.00	0.00 \$ 13,830
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00 0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				1.00	0.00	0.00 13,830
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00 0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00 0
3. ( 1 ) GRADUATE STUDENTS						21,223
4. ( 0 ) UNDERGRADUATE STUDENTS						0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6. ( 0 ) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						35,053
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						6,121
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						41,174
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
TOTAL EQUIPMENT						0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						1,780
2. FOREIGN						500
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 8,000						
3. SUBSISTENCE 2,000						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 10 ) TOTAL PARTICIPANT COSTS						10,000
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						1,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						7,812
TOTAL OTHER DIRECT COSTS						8,812
H. TOTAL DIRECT COSTS (A THROUGH G)						62,266
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
<b>All less tuition (G6) (Rate: 51.0000, Base: 54454)</b>						
TOTAL INDIRECT COSTS (F&A)						27,772
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						90,038
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						\$ 90,038 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME				FOR NSF USE ONLY		
<b>Edward A Fox</b>				INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG
<b>Ross verbrugge</b>						

2 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535057



# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION				FOR NSF USE ONLY		
<b>Virginia Polytechnic Institute and State University</b>				PROPOSAL NO.		DURATION (months)
						Proposed
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Edward A Fox</b>				AWARD NO.		
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. <b>Edward A Fox - Professor</b>				1.00	0.00	0.00 \$ 14,739
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00 0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				1.00	0.00	0.00 14,739
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00 0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00 0
3. ( 1 ) GRADUATE STUDENTS						21,860
4. ( 0 ) UNDERGRADUATE STUDENTS						0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6. ( 0 ) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						36,599
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						6,467
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						43,066
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
TOTAL EQUIPMENT						0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						1,860
2. FOREIGN						500
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 8,000						
3. SUBSISTENCE 2,000						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 10 ) TOTAL PARTICIPANT COSTS						10,000
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						1,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						8,515
TOTAL OTHER DIRECT COSTS						9,515
H. TOTAL DIRECT COSTS (A THROUGH G)						64,941
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>All less tuition (G6) (Rate: 51.0000, Base: 56426)</b>						
TOTAL INDIRECT COSTS (F&A)						28,777
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						93,718
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						\$ 93,718 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME <b>Edward A Fox</b>				FOR NSF USE ONLY		
ORG. REP. NAME* <b>Ross verbrugge</b>				INDIRECT COST RATE VERIFICATION		
				Date Checked	Date Of Rate Sheet	Initials - ORG

3 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535057

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION				FOR NSF USE ONLY		
<b>Virginia Polytechnic Institute and State University</b>				PROPOSAL NO.		DURATION (months)
						Proposed
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Edward A Fox</b>				AWARD NO.		
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. <b>Edward A Fox - Professor</b>				3.00	0.00	0.00 \$ 41,555
2.						
3.						
4.						
5.						
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00 0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				3.00	0.00	0.00 41,555
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00 0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00 0
3. ( 3 ) GRADUATE STUDENTS						63,688
4. ( 0 ) UNDERGRADUATE STUDENTS						0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6. ( 0 ) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						105,243
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						18,290
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						123,533
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
\$ 2,000						
TOTAL EQUIPMENT						2,000
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						5,340
2. FOREIGN						1,500
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 24,000						
3. SUBSISTENCE 6,000						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 30 ) TOTAL PARTICIPANT COSTS						30,000
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						3,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						23,494
TOTAL OTHER DIRECT COSTS						26,494
H. TOTAL DIRECT COSTS (A THROUGH G)						188,867
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
TOTAL INDIRECT COSTS (F&A)						83,320
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						272,187
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						\$ 272,187 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME				FOR NSF USE ONLY		
<b>Edward A Fox</b>				INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG
<b>Ross verbrugge</b>						

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535057

## Budget Justification Page

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**PI Fox will work 1 month each year. He will supervise a graduate research assistant (GRA), working toward a PhD. The tuition costs are shown under G.6 Other.**

**Fringe benefits rates are scheduled to change on 7/1/2006. For faculty the rates shift downward from 33.25% to 32.75%. For the GRA the rate shifts from 6.25% to 7.5%.**

**In year 1 a computer will be purchased for the GRA, for use during the course of the project.**

**Travel will support collaboration with UNC-CH, work with the Advisory Board, and attendance at key conferences (e.g., JCDL, ECDL) both to obtain advice and disseminate results.**

**Participant costs of \$10,000 per year will support 10 of the best doctoral students working in the DL area so they may attend the Doctoral Seminar/Consortium connected with the ACM IEEE-CS Joint Conference on Digital Libraries, the premiere DL event of the year. These students and their advisors will provide input and advise regarding DL curriculum development, so that the latest research can be integrated with education, and so that learning resources related to their research can be included in CITIDEL to stimulate further dissemination.**

**Materials and supplies will cover media, laboratory supplies, paper, printing, books, and related costs.**

**Indirect is charged at 51% of all direct costs, except for equipment and tuition.**

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION				FOR NSF USE ONLY			
<b>University of North Carolina at Chapel Hill</b>				PROPOSAL NO.		DURATION (months)	
						<div style="display: flex; justify-content: space-between;"> <span>Proposed</span> <span>Granted</span> </div>	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Barbara M Wildemuth</b>				AWARD NO.			
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	
				CAL	ACAD	SUMR	Funds granted by NSF (if different)
1. <b>Barbara M Wildemuth - Professor</b>				0.00	0.00	1.00	\$ 11,366
2. <b>Jeffrey Pomerantz - Asst Professor</b>				0.00	0.00	1.00	6,333
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	2.00	17,699
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. ( 1 ) GRADUATE STUDENTS							20,000
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							37,699
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							6,195
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							43,894
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
\$ 0							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							4,000
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 0							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							1,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							9,413
TOTAL OTHER DIRECT COSTS							10,413
H. TOTAL DIRECT COSTS (A THROUGH G)							58,307
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>All direct costs except tuition (Rate: 46.0000, Base: 54894)</b>							
TOTAL INDIRECT COSTS (F&A)							25,251
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							83,558
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 83,558
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Barbara M Wildemuth</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Vickie elmore</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

1 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535060

# SUMMARY PROPOSAL BUDGET

YEAR 2

ORGANIZATION				FOR NSF USE ONLY			
<b>University of North Carolina at Chapel Hill</b>				PROPOSAL NO.		DURATION (months)	
						<div style="display: flex; justify-content: space-between;"> <span>Proposed</span> <span>Granted</span> </div>	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Barbara M Wildemuth</b>				AWARD NO.			
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	
				CAL	ACAD	SUMR	Funds granted by NSF (if different)
1. <b>Barbara M Wildemuth - Professor</b>				0.00	0.00	1.00	\$ 11,821
2. <b>Jeffrey Pomerantz - Asst Professor</b>				0.00	0.00	1.00	6,586
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	2.00	18,407
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. ( 1 ) GRADUATE STUDENTS							20,800
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							39,207
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							6,391
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							45,598
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
\$ 0							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							4,000
2. FOREIGN							2,500
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 0							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							1,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							9,584
TOTAL OTHER DIRECT COSTS							10,584
H. TOTAL DIRECT COSTS (A THROUGH G)							62,682
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>All direct costs except tuition (Rate: 46.0000, Base: 59097)</b>							
TOTAL INDIRECT COSTS (F&A)							27,185
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							89,867
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 89,867
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME				FOR NSF USE ONLY			
<b>Barbara M Wildemuth</b>				INDIRECT COST RATE VERIFICATION			
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG	
<b>Vickie elmore</b>							

2 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535060

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION				FOR NSF USE ONLY			
<b>University of North Carolina at Chapel Hill</b>				PROPOSAL NO.		DURATION (months)	
						<div style="display: flex; justify-content: space-between;"> <span>Proposed</span> <span>Granted</span> </div>	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Barbara M Wildemuth</b>				AWARD NO.			
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	
				CAL	ACAD	SUMR	Funds granted by NSF (if different)
1. <b>Barbara M Wildemuth - Professor</b>				0.00	0.00	1.00	\$ 12,293
2. <b>Jeffrey Pomerantz - Asst Professor</b>				0.00	0.00	1.00	6,850
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	2.00	19,143
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. ( 1 ) GRADUATE STUDENTS							21,632
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							40,775
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							6,594
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							47,369
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)  <div style="text-align: right; margin-right: 100px;">\$ 0</div>							
TOTAL EQUIPMENT							0
E. TRAVEL            1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							4,000
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS        \$ _____ 0							
2. TRAVEL            _____ 0							
3. SUBSISTENCE    _____ 0							
4. OTHER            _____ 0							
TOTAL NUMBER OF PARTICIPANTS    ( 0 )            TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							1,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							9,763
TOTAL OTHER DIRECT COSTS							10,763
H. TOTAL DIRECT COSTS (A THROUGH G)							62,132
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>All direct costs except tuition (Rate: 46.0000, Base: 58369)</b>							
TOTAL INDIRECT COSTS (F&A)							26,850
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							88,982
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 88,982
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Barbara M Wildemuth</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Vickie elmore</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

3 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535060

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>University of North Carolina at Chapel Hill</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Barbara M Wildemuth</b>				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Barbara M Wildemuth - Professor</b>				0.00	0.00	3.00	\$ 35,480
2. <b>Jeffrey Pomerantz - Asst Professor</b>				0.00	0.00	3.00	19,769
3.							
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	6.00	55,249
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL ASSOCIATES				0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. ( 3 ) GRADUATE STUDENTS							62,432
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							117,681
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							19,180
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							136,861
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
\$ 0							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							12,000
2. FOREIGN							2,500
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 0							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							3,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							28,760
TOTAL OTHER DIRECT COSTS							31,760
H. TOTAL DIRECT COSTS (A THROUGH G)							183,121
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							79,286
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							262,407
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 262,407
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Barbara M Wildemuth</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Vickie elmore</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0535060

## Budget Justification

### A. Senior personnel

PI and Co-PI salaries are computed as one month (1/9) of expected 2005-2006 academic year salary. Salaries of PI and Co-PI show increases of 4% in each of years 2 and 3.

### B3. Other personnel: Graduate students

The graduate student stipend is set at \$20,000 for a 12-month appointment; it shows a 4% increase in each of years 2 and 3. The graduate student will be a SILS PhD student.

### C. Fringe benefits

Fringe benefits for the PI and Co-PI are computed as 19% of their salaries. The fringe benefits for the graduate student are computed as 7.65% of the stipend, plus \$1302 per year for student insurance.

### E.1 Travel: Domestic

Funds are requested for two members of the UNC research team to attend one conference per year (e.g., JCDL or ASIST). Each conference attendance is estimated at \$1300 (conference registration, hotel, economy airfare), thus the total for each year is \$2600.

Each year, two members of the UNC team will travel to Virginia Tech for a research group meeting. The costs of this trip include ground travel (115 miles @ \$0.405), hotel and per diem. It is estimated that each trip will cost \$650.

Each year, two members of the UNC research team will attend the annual Advisory Board meeting. The costs of this trip include ground or air travel, hotel and per diem. The cost of this travel is estimated to be \$750 per year.

### E.2 Travel: Foreign

During the second year, the budget includes travel funds for one member of the UNC team to attend a European conference (e.g., ECDL). Due to the extra costs of international travel, this conference attendance is estimated at \$2500.

### G.1 Other direct costs: Materials and supplies

Funds are requested for media, laboratory supplies, paper, printer, and basic copying and shipping costs. We request \$1000 per year for such supplies.

### G.6 Other direct costs: Other

*Tuition:* Funds are requested for graduate student tuition for fall and spring semesters throughout the project period. Current tuition rates are \$1706.50 per semester for in-state students. We request that amount for the first year and 5% more in each of the following years. This amount is *not* included in the base amount for calculating indirect costs.

*Support for Advisory Board meetings:* Each year, the research team will convene a meeting of its Advisory Board (11 members). It is expected that this meeting will occur in conjunction with the



ASIS&T annual meeting or the JCDL annual meeting, since most Advisory Board members will be attending these meetings with the support of their home institutions. Thus, the budget for these meetings includes travel to the meeting for seven members and one night hotel stay for all Advisory Board members, plus per diem. The total cost per year is expected to be \$6000.

I. Indirect costs

Indirect costs of 46% are computed on all direct costs, except tuition.

## Current and Pending Support

**See GPG Section II.D.8 for guidance on information to include on this form.**

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.			
Investigator: Edward A. Fox		Other agencies (including NSF) to which this proposal has been/will be submitted:	
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Computing and Information Technology Interactive Digital Educational Library (CITIDEL)</b>			
Source of Support: <b>NSF</b>			
Total Award Amount: <b>\$835,000</b>		Total Award Period Covered: <b>08/13/01-05/31/05</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>1.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Extending Retrieval with Stepping Stones and Pathways</b>			
Source of Support: <b>NSF</b>			
Total Award Amount: <b>\$124,250</b>		Total Award Period Covered: <b>09/01/03-08/31/05</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.69</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Information Technology Research: Managing Complex Information Applications: An Archaeology Digital Library</b>			
Source of Support: <b>CWRU (Subcontract from NSF)</b>			
Total Award Amount: <b>\$189,500</b>		Total Award Period Covered: <b>09/01/03-08/31/05</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>1.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Collaborative Project: The OCKHAM Library Network, Integrating the NSDL into Traditional Library Services</b>			
Source of Support: <b>NSF (with lead collaborative grantee Emory University)</b>			
Total Award Amount: <b>\$99,232</b>		Total Award Period Covered: <b>09/01/03-08/31/05</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.65</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Development of New Innovative Digital Library</b>			
Source of Support: <b>National Institute of Aerospace</b>			
Total Award Amount: <b>\$40,000</b>		Total Award Period Covered: <b>12/01/03-05/31/05</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Relief for Canine Hip Dysplasia Related Pain through Reiki</b>			
Source of Support: <b>Argyll Foundation</b>			
Total Award Amount: <b>\$8,500</b>		Total Award Period Covered: <b>08/01/04-07/31/05</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Study of User Quality Metrics for Metasearch Retrieval Ranking</b>			
Source of Support: <b>Emory University (proposal to IMLS)</b>			
Total Award Amount: <b>\$64,880</b>		Total Award Period Covered: <b>10/01/04-09/30/06</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.12</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
<b>*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.</b>			

## Current and Pending Support

See GPG Section II.D.8 for guidance on information to include on this form.

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.			
Investigator: Edward A. Fox		Other agencies (including NSF) to which this proposal has been/will be submitted:	
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Reformulating General Engineering and Biological Systems Engineering at Virginia Tech</b>			
Source of Support: <b>NSF</b>			
Total Award Amount: <b>\$996,238</b>		Total Award Period Covered: <b>01/01/05-12/31/07</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Collaborative Project: Superimposed Tools for Active Arrangement and Elaboration of Educational Resources</b>			
Source of Support: <b>Portland State University</b>			
Total Award Amount: <b>\$112,501</b>		Total Award Period Covered: <b>01/01/05-12/31/06</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.60</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Acknowledgements in Digital Libraries to Enhance Teaching &amp; Learning</b>			
Source of Support: <b>NSF (subcontract from proposal by Penn State)</b>			
Total Award Amount: <b>\$232,969</b>		Total Award Period Covered: <b>09/1/05-08/31/08</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>1.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Evaluation of a web-based alcohol abuse tutorial system</b>			
Source of Support: <b>National Institute of Health</b>			
Total Award Amount: <b>\$876,761</b>		Total Award Period Covered: <b>07/01/05 – 06/30/08</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>1.80</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Personalization of content: Bridging the gap between the NSDL and its users</b>			
Source of Support: <b>NSF</b>			
Total Award Amount: <b>\$500,000</b>		Total Award Period Covered: <b>9/1/05 – 8/31/08</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.50</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>CNITE: A community network for IT education</b>			
Source of Support: <b>NSF</b>			
Total Award Amount: <b>\$573,447.00</b>		Total Award Period Covered: <b>09/01/05 – 08/31/08</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.50</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Application of Formal Digital Library Models to the NSDL</b>			
Source of Support: <b>NSF (subcontract from AUSI)</b>			
Total Award Amount: <b>\$205,319</b>		Total Award Period Covered: <b>10/1/05 – 9/31/08</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>1.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support			
Project/Proposal Title: <b>Collaborative Project: Digital Library Interoperability and Community Involvement in the NSDL Digital Library Services Registry</b>			
Source of Support: <b>NSF (subcontract from Oregon State U.)</b>			
Total Award Amount: <b>\$109,037</b>		Total Award Period Covered: <b>10/1/05 – 9/31/07</b>	
Location of Project: <b>Virginia Tech</b>			
Person-months committed to project: Cal: <b>0.69</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
<b>*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.</b>			

## Current and Pending Support

See GPG Section II.D.8 for guidance on information to include on this form.

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.			
Investigator: Edward A. Fox		Other agencies (including NSF) to which this proposal has been/will be submitted:	
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: <b>Knowledge Creation and Integration for NSDL: Learning Support for DLs</b> Source of Support: <b>NSF (subcontract from U. of Arizona)</b> Total Award Amount: <b>\$100,000</b> Total Award Period Covered: <b>01/01/06-12/31/07</b> Location of Project: <b>Virginia Tech</b> Person-months committed to project: Cal: <b>0.46</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: <b>Enhancing the quality and understanding the use of NSDL</b> Source of Support: <b>NSF (subcontract from U. of Arizona)</b> Total Award Amount: <b>\$112,501</b> Total Award Period Covered: <b>01/01/05-12/31/06</b> Location of Project: <b>Virginia Tech</b> Person-months committed to project: Cal: <b>0.60</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: <b>Reusing Human-Computer Interaction Design Knowledge for Interface Design</b> Source of Support: <b>NSF</b> Total Award Amount: <b>\$490,906</b> Total Award Period Covered: <b>1/1/06 – 12/31/08</b> Location of Project: <b>Virginia Tech</b> Person-months committed to project: Cal: <b>0.67</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: <b>Collaborative Research: Curriculum Development: Digital Libraries</b> Source of Support: <b>NSF</b> Total Award Amount: <b>\$272,187</b> Total Award Period Covered: <b>1/1/06 – 12/31/08</b> Location of Project: <b>Virginia Tech</b> Person-months committed to project: Cal: <b>1.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: <b>Intelligent GP Fusion from Multiple Sources for Text Classification</b> Source of Support: <b>NSF</b> Total Award Amount: <b>\$251,511</b> Total Award Period Covered: <b>1/1/06 – 12/31/08</b> Location of Project: <b>Virginia Tech</b> Person-months committed to project: Cal: <b>1.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: Source of Support: Total Award Amount: Total Award Period Covered: Location of Project: Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: Source of Support: Total Award Amount: Total Award Period Covered: Location of Project: Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: Source of Support: Total Award Amount: Total Award Period Covered: Location of Project: Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission planned in near future <input type="checkbox"/> Transfer of support Project/Proposal Title: Source of Support: Total Award Amount: Total Award Period Covered: Location of Project: Person-months committed to project: Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>0.00</b>			
<b>*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.</b>			

## Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.			
Investigator: <b>Barbara Wildemuth</b>		Other agencies (including NSF) to which this proposal has been/will be submitted.	

Support:	<input type="checkbox"/> Current	<input checked="" type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title: <b>Recruiting Medical Students into Health Sciences Librarianship: Pursuing the Informationist Concept through a Dual Degree Model</b>				
Source of Support: <b>Institute for Museum &amp; Library Services (IMLS)</b>				
Total Award Amount: \$		Total Award Period Covered: <b>12/15/05 - 12/14/08</b>		
Location of Project: <b>UNC-CH</b>				
Person-Months Per Year Committed to the Project.		Cal: <b>0.00</b>	Acad: <b>0.54</b>	Sumr: <b>0.00</b>

Support:	<input type="checkbox"/> Current	<input checked="" type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title: <b>Striking a Balance: The Effort/Outcome Tradeoff in Video Interaction</b>				
Source of Support: <b>NSF</b>				
Total Award Amount: \$		Total Award Period Covered: <b>10/01/05 - 09/30/08</b>		
Location of Project: <b>UNC-CH</b>				
Person-Months Per Year Committed to the Project.		Cal: <b>0.00</b>	Acad: <b>0.00</b>	Sumr: <b>1.00</b>

Support:	<input type="checkbox"/> Current	<input checked="" type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title: <b>Collaborative Research: Curriculum Development: Digital Libraries</b>				
Source of Support: <b>NSF</b>				
Total Award Amount: \$		Total Award Period Covered: <b>01/01/06 - 12/31/08</b>		
Location of Project: <b>UNC-CH</b>				
Person-Months Per Year Committed to the Project.		Cal: <b>0.00</b>	Acad: <b>0.00</b>	Sumr: <b>1.00</b>

Support:	<input type="checkbox"/> Current	<input type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
Source of Support:				
Total Award Amount: \$		Total Award Period Covered:		
Location of Project:				
Person-Months Per Year Committed to the Project.		Cal:	Acad:	Sumr:

Support:	<input type="checkbox"/> Current	<input type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
Source of Support:				
Total Award Amount: \$		Total Award Period Covered:		
Location of Project:				
Person-Months Per Year Committed to the Project.		Cal:	Acad:	Summ:

\*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

## Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: <b>Jeffrey Pomerantz</b>	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: <b>State Library of North Carolina Needs Assessment and Marketing Study Plan</b>
Source of Support: <b>State Library of North Carolina</b> Total Award Amount: \$ <b>50,935</b> Total Award Period Covered: <b>01/01/05 - 08/31/05</b> Location of Project: <b>Chapel Hill, NC</b> Person-Months Per Year Committed to the Project.    Cal: <b>0.00</b> Acad: <b>0.00</b> Sumr: <b>2.40</b>

Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: <b>BASIS: Botanical Access to Studying Invasive Species</b>
Source of Support: <b>Institute of Museum and Library Services</b> Total Award Amount: \$ <b>768,247</b> Total Award Period Covered: <b>09/01/05 - 08/31/08</b> Location of Project: <b>Chapel Hill, NC</b> Person-Months Per Year Committed to the Project.    Cal: <b>0.00</b> Acad: <b>3.00</b> Sumr: <b>0.00</b>

Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: <b>Digital Teaching, Research, and Educational Engagement (Digital TREE)</b>
Source of Support: <b>NSF, Directorate for Education and Human Resources</b> Total Award Amount: \$ <b>490,876</b> Total Award Period Covered: <b>01/01/06 - 12/31/08</b> Location of Project: <b>Chapel Hill, NC</b> Person-Months Per Year Committed to the Project.    Cal: <b>0.00</b> Acad: <b>2.40</b> Sumr: <b>0.00</b>

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title:
Source of Support: Total Award Amount: \$                      Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project.    Cal:                      Acad:                      Sumr:

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title:
Source of Support: Total Award Amount: \$                      Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project.    Cal:                      Acad:                      Summ:

\*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

(See GPG Section II.C.2.h for guidance on information to include on this form.)

Investigator: **Jeff Pomerantz**Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ \*Transfer of SupportSource of Support: **NSF**

**Total Award Amount: \$ 262,406 Total Award Period Covered: 01/01/06 - 12/31/08**

Location of Project: **UNC-CH**

Person-Months Per Year Committed to the Project.    Cal:0.00    Acad: 0.00    Sumr: 1.00

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ \*Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: \$ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project.      Cal:              Acad:              Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ \*Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: \$ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project.      Cal:              Acad:              Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ \*Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: \$ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project.      Cal:              Acad:              Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ \*Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: \$ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project.	Cal:	Acad:	Summ:
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## FACILITIES, EQUIPMENT & OTHER RESOURCES

**FACILITIES:** Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

**Laboratory:** The Virginia Tech Digital Library Research Laboratory (DLRL) is intended to support digital library research activities on campus. Its neighbors in the same building, dedicated late in 2000 as Torgersen Hall after the most recent university president, include roughly 10 other research (continued)

**Clinical:**

**Animal:**

**Computer:** Next door to the DLRL in Torgersen Hall is the Laboratory for Advanced Scientific Computing and Applications, which features a Spring 2004 upgraded 200-node AMD Opteron/Myrinet parallel computing cluster. Additional resources include a 12 processor SGI Altix 3300 and numerous workstations.

**Office:** The Dept of CS is well equipped to support DL research. It hosts 2 computer labs. In addition, it houses two specialized labs for HCI research, that have a total of 7 rooms, 1 specially equipped for video-teleconferencing and decision support, and the others designed for usability evaluation studies.

**Other:**

**MAJOR EQUIPMENT:** List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

Virginia Tech's System X ("System Ten") officially ranks 7th on the 24th TOP500 List released November 2004. Virginia Tech, teaming with Apple Computer, Cisco, Liebert, and Mellanox Technologies, has introduced a new solution for creating supercomputing clusters. The university designed a large 64-bit InfiniBand cluster using existing, off-the-shelf industry components. There are 1100 nodes, each a 2.3 GHz dual-processor Xserve G5. Details can be found at [www.tcf.vt.edu](http://www.tcf.vt.edu).

**OTHER RESOURCES:** Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

The Computing Center provides information processing services for the campus, including servers of all sizes for various tasks. These servers include systems by IBM, DEC, Sun, and SGI.

Virginia Tech boasts a rich network infrastructure. The campus backbone serves over 15,000 desktops in campus building LANs. (continued on next page)



## **FACILITIES, EQUIPMENT & OTHER RESOURCES**

Continuation Page:

### **LABORATORY FACILITIES (continued):**

groups, providing a fertile ground for collaboration. For example, Virginia Tech Digital Library and Archives, part of VT University Libraries, is also in the \$30M new building. As VT's Advanced Communications and Information Technology Center, the building hosts an 11 Mbps wireless network as well as a 36 Gbps Ethernet backplane to which the DLRL connects via a mixture of 10 Base T and 100 Base T hardwired connections. Other building labs include those for HCI research, multimedia, visualization and virtual environments (including a CAVE), digital discourse, computers and the humanities, etc. The neighboring Laboratory for Advanced Scientific Computing and Applications has an 200-node Beowulf cluster with newly upgraded high end PCs with Myrinet Gbit interconnect.

The DLRL is currently occupied mainly by graduate students engaged in digital library research. For several years it has supported a continuous stream of visiting scholars (in early 2001 for example there were two from South Korea and one each from India and Japan). It houses primarily a variety of PCs, some running Linux and others running Windows with some Macintosh systems as well (including two G5 nodes like those in System X, for prototyping work that can be ported there). There is desktop support as well as aid for multi-platform interoperability testing. There are many UNIX-based workstations, from Dell, IBM, Sun, etc., as well as Linux servers. Also available are scanners, printers, and DVD/CD-R writers. There are student carrels, a conference room (with videoconferencing, speaker phone, screen/projector), and office space for visiting faculty and collaborators.

### **OTHER RESOURCES (continued):**

Virginia Tech plays a key role in NetworkVirginia (<http://www.networkvirginia.net/>), a mature statewide network. This provides high-bandwidth connectivity to Virginia Tech's geographically scattered campus. It is able to support multimedia-intense activities such as video teleconferencing.

Virginia Tech also manages the Virginia gigaPOP providing access for R1 institutions throughout the mid-Atlantic region to next generation networks including Internet2's Project Abilene Network, the Department of Energy's ESnet, and the National Science Foundation's vBNS network. Campus network users all have access to these resources currently. Virginia Tech is a charter member of the Internet2 (<http://www.internet2.edu>) initiative and provided leadership in the Mid-Atlantic Crossroads (MAX) initiative (see <http://www.networkvirginia.net/MAX>). Current focus is on the National LambdaRail.

Virginia Tech is an active participant in wireless networking technologies. Its Center for Wireless Telecommunications (<http://www.cwt.vt.edu>) obtained licenses to operate in the 1150 MHz wireless spectrum in the Greater Roanoke, Danville, Martinsville and Kingsport-Johnson City market areas, as part of the FCC's first Local Multipoint Distribution Service (LMDS) auction – allowing LMDS research efforts.

## FACILITIES, EQUIPMENT & OTHER RESOURCES

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**FACILITIES:** Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

**Laboratory:**

**Clinical:**

**Animal:**

**Computer:** The work performed by Drs. Wildemuth and Pomerantz will primarily be carried out in their offices in Manning Hall, with standard desktop and laptop computing equipment. Desktop computers are networked (UNC has an internet 2 node) and Manning Hall is wireless ready with the 802.11b

**Office:** Printing and photocopying equipment is available, as well as secretarial support for this project.

**Other:**

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**MAJOR EQUIPMENT:** List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

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**OTHER RESOURCES:** Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

**Secretarial support will be available to this project. In addition, the community of scholars represented by the Center for Research and Development of Digital Libraries (CRADLE, <http://ils.unc.edu/cradle/>) will be available for consultation.**

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## **FACILITIES, EQUIPMENT & OTHER RESOURCES**

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Continuation Page:

### **COMPUTER FACILITIES (continued):**

**standard. The School is equipped with multimedia equipment such as scanners, digital and video cameras, and digital audio recorders.**

April 29, 2005

Edward A. Fox  
Department of Computer Science  
Virginia Tech  
Blacksburg VA 24061 USA

Dear Ed,

I am writing in support of your proposal "Collaborative Research: Curriculum Development: Digital Libraries" for a 3 year award from NSF/CISE/IIS, as specified in document NSF-05-551, Information and Intelligent Systems (IIS) Solicitation. Virginia Tech's support of your research leave this semester has provided a strong foundation for the proposed work. This leave also provided a good opportunity to elaborate in book form your insights into digital libraries and, especially, your "5S framework."

I am pleased to encourage your continuing involvement in computer science education innovation that has been of great benefit to the department. Your past successful contributions in this area have included the well received JETT workshop last July, your service as chair of our department's Undergraduate Program Committee and member of the College of Engineering's Curriculum Committee, and an impressive record of NSF support, dating back to at least 1991, including serving as PI for the 1993 award from the CISE Education Infrastructure project that allowed the department to be one of the first to include CS course materials on the WWW. These efforts mirror your own success and demonstrate the long-standing commitment of the institution. Also of great benefit to our students and to students more globally is our hosting of major resources including the Computer Science Teaching Center ([www.cstc.org](http://www.cstc.org)), and the Computing and Information Technology Interactive Digital Education Library ([www.citidel.org](http://www.citidel.org)), and key portions both of the Networked Computer Science Technical Reference Library ([www.ncstrl.org](http://www.ncstrl.org)) and the Networked Digital Library of Theses and Dissertations ([www.ndltd.org](http://www.ndltd.org)).

I am also happy to encourage your specific work on educational materials development benefiting both graduate and undergraduate students, in CS and other areas of Engineering, who are interested in the Information area. These materials provide excellent learning resources in digital libraries, information retrieval and multimedia. Our curriculum will continue to include existing courses in these area (such as CS4624, CS5604, and CS6604) and we have a variety of venues to refine the proposed materials.

Additionally, I strongly support the partnership with the School of Information and Library Science of the University of North Carolina at Chapel Hill. This collaboration will bridge the com-

puter science and library science perspectives that underlie the digital library field. The interaction among a substantial (ten) group of faculty at Virginia Tech with a group of that size at UNC-CH combined with members of the proposed Advisory Board, create a significant community of scholars that will have real impact on research and education.

In summary, I am pleased to be able to lend my support to your proposal that will have a substantial benefit on computer science education both at Virginia Tech and nationally.

Sincerely,

A handwritten signature in black ink, appearing to read "Dennis Kafura".

Dennis Kafura  
Professor and Head

Thursday, May 5, 2005

Edward A. Fox  
Department of Computer Science  
660 McBryde Hall, M/C 0106  
Virginia Tech  
Blacksburg VA 24061 USA  
FAX: +1-540-231-6075

Dear Ed,

I am writing in support of your proposal "Collaborative Research: Curriculum Development: Digital Libraries" for a 3 year award from NSF/CISE/IIS, as specified in document NSF-05-551, Information and Intelligent Systems (IIS) Solicitation.

First, I am pleased to encourage your continuing involvement in computer science education innovation on our campus. Your work to assist with the JETT workshop last July, and your service as chair of our CS Department's Undergraduate Program Committee and member of the College's Curriculum Committee, attest to your leadership efforts in this area. Your long record of NSF funding in this arena, dating back to 1991 and before, including serving as PI for the 1993 award from the CISE Education Infrastructure project that allowed the CS Department to be one of the first to include CS course materials on the WWW, attest to both your commitment and that of VT. Our hosting of the Computer Science Teaching Center ([www.cstc.org](http://www.cstc.org)) and the Computing and Information Technology Interactive Digital Education Library ([www.citidel.org](http://www.citidel.org)), as well as key portions of the Networked Computer Science Technical Reference Library ([www.ncstrl.org](http://www.ncstrl.org)) and the Networked Digital Library of Theses and Dissertations ([www.ndltd.org](http://www.ndltd.org), which includes computing as one of its many areas), attest to Virginia Tech's support of these efforts. These and other endeavors of the Digital Library Research Laboratory, which you continue to direct, are of help to our students and across the nation.

Second, I am happy to encourage your specific work on educational materials development. It will be of benefit to both graduate and undergraduate students, in CS and other areas of Engineering, who are interested in the Information area, to be able to learn from the materials you will be developing, related to digital libraries, as well as related areas such as information retrieval and multimedia. We will continue to offer classes (CS4624, CS5604, and CS6604) in these areas. In accord with the recommendation of the Undergraduate Program Committee, we also will be happy for you to teach special topics, honors, and other new undergraduate offerings in this area, in which the new materials can be tested, refined, and validated.

Third, I am pleased that Virginia Tech has supported and funded your research leave in Spring 2005 that provides a strong foundation for the proposed work. Since you have been spending the Spring Semester to work on a book on digital libraries that continues your ongoing work on the “5S framework”, that should jump-start the activities that NSF funding can help expand over the proposed three-year period.

Fourth, I encourage your planned collaboration with the School of Information and Library Science of the University of North Carolina at Chapel Hill. Partnering with this leading LIS program in the nation, to work on digital libraries curriculum development, should balance and leverage the CS and LIS perspectives that underlie the digital library field. Your inclusion of 10 faculty from across the VT campus in collaboration with similar sized groups from across the UNC-CH campus, as well as leading experts from across the nation who have agreed to serve on the Advisory Board, should stimulate further collaboration on both educational and research projects.

Finally, in summary, I am happy to encourage and support your proposed efforts, and look forward to the positive impact on computing education here at Virginia Tech and across the country.

Sincerely yours,

A handwritten signature in blue ink, appearing to read "Hassan Aref", with a long horizontal stroke extending from the end of the name.

Hassan Aref  
*Dean of Engineering*  
*Reynolds Metals Professor*



**UNC**  
SCHOOL OF INFORMATION  
AND LIBRARY SCIENCE

THE UNIVERSITY  
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<http://sils.unc.edu>

**JOSÉ-MARIE GRIFFITHS, PH.D.**  
*Dean and Professor*  
[jmgriff@unc.edu](mailto:jmgriff@unc.edu)

May 5, 2005

Barbara Wildemuth (PI) and  
Jeffrey Pomerantz (Co-PI)  
School of Information and Library Science  
University of North Carolina  
Chapel Hill, NC 27599-3360

Dear Barbara and Jeff,

I am pleased to write in support of your proposal "Collaborative Research: Curriculum Development: Digital Libraries" for a 3 year award from NSF/CISE/IIS, as specified in document NSF-05-551, Information and Intelligent Systems (IIS) Solicitation. This collaborative research with Virginia Tech will promote a synergistic relationship between the fields of computer science and information and library science, benefiting both fields in the development of a curriculum and educational materials supporting graduate education in the critical area of digital libraries.

You have both contributed to SILS' curriculum development and teaching in the past, and this effort will provide continued benefits to the School and the field at large. Your past contributions to such efforts include Barbara's service in developing and managing our undergraduate program in information science and her active participation in both the ASIS&T Education Committee and its annual Doctoral Seminar, and Jeff's activities as a practitioner in a digital library setting and his continued development of the SILS course on digital libraries. Your combined active involvement in digital library curricular and educational issues on both local and national levels has found an additional venue in the proposed work on digital library education.

Education in digital libraries is a growing area in information and library science. Digital library projects, begun as experiments in providing materials over time and distance, are now being incorporated into ongoing library functions. Issues related to the development and sustainability of such libraries, and the services that need to be provided by such libraries, are being addressed by current research. That research now should be brought into the classroom, so that the next generation of digital librarians is adequately prepared to shape and manage their libraries.


This project is strengthened by the collaboration with Virginia Tech's Computer Science, led by Ed Fox, a well-known authority in the area of digital libraries.



Participation from a number of SILS faculty, with particular expertise related to digital libraries, as well as other faculty at UNC-CH, provides a strong foundation for accomplishing the project's goals. These two institutions, their participating faculty, and the additional Advisory Board members, will provide a strong base from which the results of the project can be developed and disseminated. I anticipate that they will have a significant impact on digital library education in both information and library science and computer science.

In summary, I am pleased to offer the School's support and my personal support to your proposal. I look forward to the positive impact it will have on our School, on other schools of information and library science, and on digital libraries education nationally.

Sincerely,

A handwritten signature in dark ink, reading "José-Marie Griffiths". The signature is fluid and cursive, with a large initial "J" and a long, sweeping underline.

José-Marie Griffiths  
Dean and Professor  
School of Information and Library Science

